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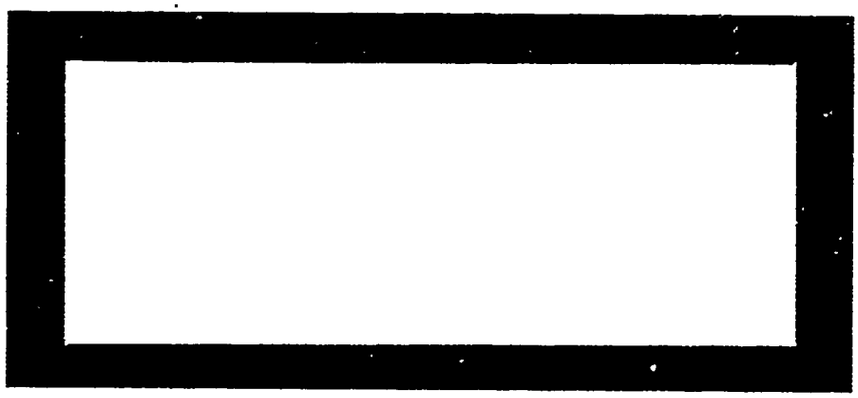
ABSTRACT

A brief description of 156 unpublished evaluation instruments constructed mostly between 1964 and 1968 is presented in this handbook to facilitate selection of appropriate test forms by researchers in science education. The instruments are related to all levels of elementary, secondary, and college instruction and classified under the headings: Achievement in Science, Achievement in Processes and Skills of Science, Characteristics and Abilities of Students, Attitudes, Knowledge of the Nature of Science, and Professional Practices. The achievement section is identified with such science areas as: general biology, ecology, zoology, earth science, anthropology, astronomy, geology, chemistry, physics, and general physical science; the professional practices section is divided into instructional activities, beliefs and attitudes, supervisory practices, and teacher expectations of students. Title, factors, format, population, reliability, norms, validation, and reference are entries described in detail for each instrument. Preparation of the second volume to fill in the gap between 1968 and the present is underway. (CC)



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SCIENCE EDUCATION INFORMATION
REPORTS

OCCASIONAL PAPER SERIES - SCIENCE PAPER 7
HANDBOOK OF UNPUBLISHED EVALUATION INSTRUMENTS IN SCIENCE EDUCATION

by

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January, 1973

SCIENCE, MATHEMATICS, AND ENVIRONMENTAL EDUCATION INFORMATION REPORTS

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Stanley L. Helgeson
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HANDBOOK OF UNPUBLISHED EVALUATION INSTRUMENTS IN SCIENCE EDUCATION

By

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The primary purpose of the Handbook is to provide the researcher in science education with a ready and comprehensive source of information on unpublished evaluation instruments designed for science education studies. It is hoped that the Handbook will find wide usage and will result in more frequent utilization of available instruments than has occurred in the past. It is the opinion of the compiler of the Handbook, that much energy has been wasted in the development of instruments to measure characteristics already measureable by existing instruments. Also it is hoped that a comprehensive compilation such as represented here will also lead to identification of areas in which there is a paucity of useful instruments and thereby stimulate instrument development in these areas. The author is currently working on a review paper which will summarize this type of information.

Instruments were identified in two ways. A questionnaire was sent to the National Association For Research In Science Teaching membership in the Autumn of 1970 requesting information on instruments developed at the member's institution. A follow-up questionnaire was mailed in Autumn, 1971. Twenty-four instruments were identified in this manner. The bulk of the 156 instruments included in the Handbook, however, were identified through a search of the holdings of the Science, Mathematics, and Environmental Education Information Analysis Center.

The following criteria were used in determining whether an instrument was to be included in the handbook:

1. Objectivity - A scoring system is presented which is readily usable by other researchers. The bulk of the instruments would be classified as of the "objective" type.

2. Respondent completed - The instrument measures some characteristic held by the respondent or asks the respondent to characterize something he is familiar with. Researcher-completed observational instruments are not included.

3. Availability - The instrument must be readily available to the researcher. There are four general sources: University Microfilms for instruments included in dissertations; ERIC Microfiche collections for instruments included in documents having an ED number; a journal article for those few instruments which have been published this way; and directly from the author for those instruments sent in response to the questionnaire.

4. General usefulness - The compiler came across many content achievement instruments. Many were designed for a particular local curriculum, or to determine content outcomes of specific instructional media, such as films. Unless such instruments presented a novel format or design, they were not included.

This compilation includes instruments primarily from studies completed between 1964 and 1968. It is comprehensive for that time period. It also includes some from older studies and a number from more recent studies. An effort is now underway to fill in the gap between 1968 and the present. A second volume will be available by the end of 1973. The compiler would like to receive comments and suggestions on the usefulness of the current format and also information on additional instruments from the science education

community. These will be taken into account in the updating of the Handbook. It should be noted that the Handbook includes instruments for all levels of elementary, secondary and college instruction so the reader will need to examine each section to determine the appropriateness of an instrument within a topical area.

Frequently used symbols:

r =	reliability
$\overline{X}$ =	mean
S.D. =	standard deviation
S.E. =	standard error
BSCS =	Biological Sciences Curriculum Study
CHEMS =	Chemical Education Materials Study
N =	Population size
K-R 20 =	Kuder - Richardson 20

I. ACHIEVEMENT IN SCIENCE

A. Biological Science

1. General Biology

Title: LIFE SCIENCE CONCEPT TEST

Factors: Selected life science concepts

Format: Six pictures are presented for each concept; each picture representing a characteristic of the concept. Understanding is assessed on basis of student responses to each picture.

Population: Children in grades one through six

Reliability: r = .84 - .94 (test - retest) N = 192

Norms: $\overline{X}$ = 6.22 S.E. = .64 (grade two)

$\overline{X}$ = 18.91 S.E. = 1.25 (grade six)

Validation: Concurrent validity; correlation coefficient with Otis Test of Mental Ability ranged from 0.31 to 0.67.

Reference: Butler, Franklin D. "A Test for Measuring Selected Life Science Concepts of Elementary School Children." Unpublished doctoral dissertation, George Peabody College for Teachers, 1965, p. 74.
University Microfilms Order No. 66-4412

Title: GENERAL BIOLOGY - FINAL EXAM

Factors: Achievement in biology

Format: 80 multiple-choice items

Population: General Biology students in Jamestown Community College and in the State University of New York at Buffalo

Reliability: Not available

Norms: No overall statistics given

Validation: Content validity based on table of specifications for course content common in the two schools. Most taken from Dressel and Nelson Questions and Problems in Science (1960).

Reference: Kochersberger, Robert. "A Comparison of Achievement of General Biology Students in a Community College with

Similar Students in a University As Related to Their Backgrounds." Unpublished doctoral dissertation, State University of New York at Buffalo, 1965, pp. 110-119.
University Microfilms Order No. 65-8896

Title: 1) HOMEOSTASIS
2) LEVEL OF ORGANIZATION
3) PLANT KINGDOM
4) METABOLIC RATE TEST
5) PROBLEMS IN BOTANY

Factors: Knowledge acquisition(1-3), analytic ability (4-5)

Format: 15 to 20 true-false or multiple-choice items on each instrument

Population: Freshman and sophomore elementary education majors

Reliability: Instruments 1-3: r = .76 - .82 (Pearson product-moment correlation of split-half analysis)
Instruments 4-5; r = .67 - .74 (Pearson r correlation of test-retest scores)

Norms: Not availabile

Validation: Not available

Reference: Kuhn, David J. "A Study of Varying Modes of Topical Presentation in Elementary College Biology to Determine the Effect of Advance Organizers in Knowledge Acquisition and Retention." Unpublished doctoral dissertation, Purdue University, Lafayette, Indiana, 1967, pp. 169-187.
University Microfilms Order No. 68-6326

Title: BSCS BIOLOGY, SM EVALUATION 1968-69 (UNIT TESTS)

Factors: Achievement in five areas of the course materials of Biological Science: Patterns and Processes. The areas include; ecological relationships, cell energy processes, reproduction and development, genetic continuity, and organic evolution.

Format: Two test forms (A and B) were developed for each of the five areas. Tests consist of multiple-choice items.

Population: Students using the Biological Science: Patterns and Processes; primarily suburban and rural 10th graders, with some inner-city students and 9th, 11th and 12th grade students.

Instrument Statistics:

Test	N		r*		SE*		$\bar{X}$**		Number of items
	A	B	A	B	A	B	A	B	
Ecology	289	320	.70	.72	8.2	7.9	75	70	24
Cell Energy Processes	259	245	.73	.74	9.42	9.41	51	54	30
Reproduction and Development	220	226	.71	.74	9.3	8.9	53	53	30
Genetic Continuity	189	213	.68	.66	9.3	8.7	53	37	27-26
Evolution	No information								16

Pretest statistics on each of the two forms (A and B) for four unit tests.

* Hoyt analysis of variance

** % correct

Validation: Each area of study was analyzed for concepts which then served as guides for item development.

Reference: Mayer, William V., et. al; "A Formative Evaluation of Biological Science: Patterns and Processes." Final report Project No. 9-H-012, U.S. Department of Health, Education, and Welfare, March, 1970.
ED 039 149 MF $0.65 HC $9.87 262 pp.

Title: THE BIOLOGICAL PRINCIPLES TEST

Factors: Ability to identify and apply major biological principles

Format: 50 multiple-choice items

Population: High school seniors

Reliability: r = .73 (Split-half technique with Spearman-Brown Correlation)
N = not available

Norms: $\bar{X}$ = 25.28 Variance = 35.48 N = 1275

Validation: Content validity estimated from comparison with published lists of biological principles. Construct validity

established through evaluation of items by high school biology teachers.

Reference: Pierson, David W. "The Ability of High School Seniors to Identify and Apply Biological Principles in Problem-Solving Situations." Unpublished doctoral dissertation, University of Missouri, 1962, p. 106.
University Microfilms Order No. 65-4169

Title: UNIT ACHIEVEMENT TEST

Factors: Knowledge of respiration (BSCS unit)

Format: 40 multiple-choice items

Population: 9th grade biology students

Reliability: r = .86 (K-R 20) N = 180

Norms: Not available

Validation: Items were selected from questions contributed by 12-member jury on basis of discrimination and difficulty indices using limits established by Garrett. (Henry Garrett, Statistics for Education and Psychology, New York: Longman, Green and Company, 1962, p. 351.)

Reference: Schuck, Robert F. "An Investigation to Determine the Effects of Set Induction Upon the Achievement of Ninth Grade Pupils and Their Perception of Teacher Effectiveness in a Unit on Respiration in the BSCS Curricula." Unpublished doctoral dissertation, Arizona State University, 1968, pp. 137-143.
University Microfilms Order No. 67-15582

Title: EXAMINATION IN BIOLOGY

Factors: Knowledge of biological concepts

Format: Six subtests of 50 multiple-choice items each

Population: High school biology students

Reliability: Ranged from .71 - .81 on subtests. Established through alternate form method. (N = 421 to 607)

Norms: Percentile norms given on pp. 108-110

Validation: Concurrent validity for subtests established by comparison with total score. Content validity established by panel.

Reference: Simons, Harry A. "The Construction and Evaluation of High School Biology Unit Tests." Unpublished doctoral dissertation, New York University, 1967, p. 111.
University Microfilms Order No. 68-6185

Title: FINAL EXAMINATION

Factors: Biological facts and concepts

Format: 50 multiple-choice items

Population: Students enrolled in first course in college biology

Reliability: r = .93 Guilford method of rational equivalence

Norms: $\bar{X}$ = 27.7 S.D. = 6.96 N = 234

Validation: Content validity determined by author

Reference: Spurlin, Melvin D. "A Study of the Relationships of Sex, Ability Level and Biological Preparation to Achievement in Freshman Biology at Metropolitan State College." Unpublished doctoral dissertation, University of Colorado, 1968, pp. 146-153.
University Microfilms Order No. 68-14,237

Title: LESSON TESTS 1-11

Factors: The achievement of concepts related to the biological cell at three levels; Knowledge, Comprehension and Application (based on Bloom's Taxonomy).

Format: Combinations of multiple-choice and yes-no questions.
36 items on each test

Population: Students in grades 2 through 6; 20 students from one class at each grade level

Reliability: Varied on each test between cognitive levels; maximum range - .47 to .73, minimum .83 - .89; range for total reliability .44 to .85.

Norms: Not available

Validation: Not available

Reference: Stauss, Nyles G. "Materials Used in Teaching And Evaluating The Concepts Related to the Biological Cell in Grades 2-6." Practical Paper #2, Wisconsin Research and Development Center for Cognitive Learning, The University of Wisconsin, 1968, pp. 22-26.

Title: UNIT TESTS

Factors: Achievement on each of eight topics:

I	Botany	VI	Learning and the Nervous System
II	Nutrition and digestion		
III	Respiration	VII	Reproduction
IV	Blood and Circulation	VIII	Genetics
V	The Conquest of Disease		

Format: Objective items including matching, multiple-choice and true-false

Population: Ninth and tenth grade students of University High School, Minneapolis

Reliability: Hoyt's variation of K-R 20*

I	r = .86	VI	r = .80
II	r = .92	VII	r = .84
III	r = .90	VIII	r = .8[illegible]
IV	r = .83		
V	r = .76		

*C. J. Hoyt "Note on A Simplified Method of Computing Test Reliability." Educational and Psychological Measurement, I. (January, 1941) pp. 93-5.

Norms:

I	$\bar{X}$ = 32.83 - 37.08	S.D. = 6.53 - 9.34	(53 items)
II	$\bar{X}$ = 40.39 - 51.92	S.D. = 9.73 -12.69	(66 items)
III	$\bar{X}$ = 28.30 - 34.79	S.D. = 8.64 -11.14	(66 items)
IV	$\bar{X}$ = 37.70 - 44.33	S.D. = 6.26 - 7.71	(54 items)
V	$\bar{X}$ = 20.09 - 25.04	S.D. = 4.72 - 5.97	(35 items)
VI	$\bar{X}$ = 19.26 - 24.42	S.D. = 4.70 - 6.43	(32 items)
VII	$\bar{X}$ = 24.35 - 30.85	S.D. = 5.97 - 7.93	(41 items)
VIII	$\bar{X}$ = 19.61 - 22.77	S.D. = 4.73 - 6.45	(32 items)

Validation: Internal consistency determined through a method outlined by Frederick B. David, Items Analysis Data, Cambridge, Massachusetts: Harvard University, 1949.

Reference: Walters, Louis Lloyd. "A Comparison of Achievement in High School Biology When Taught to Ninth Grade and Tenth Grade Pupils." Unpublished doctoral dissertation, University of Minnesota, 1961, pp. 136-182.
University Microfilms Order No. 61-3690

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2. Botany

Title:	BOTANY FACTUAL EXAMINATION
Factors:	Ability to record and identify specific items of information in botany
Format:	51 items including multiple-choice, short answer and pictorial
Population:	Students enrolled in College Botany at The University of Toledo
Reliability:	r = .81 (K-R 21) N = 84
Norms:	Not available
Validation:	Comparison of items with lecture topics for content validity
Reference:	Gallentine, Jerry L. "The Effects of Overhead Projection on Achievement in the Biological Sciences at the College Level." Unpublished doctoral dissertation, The University of Toledo, 1965, pp. 76-78. University Microfilms Order No. 66-0307

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3. Ecology

Title:	POST TEST
Factors:	Knowledge, comprehension and application of ecological concepts
Format:	60 multiple-choice items
Population:	Seventh and ninth grade students
Reliability:	r = .82 (Analysis of variance)
Norms:	$\overline{X}$ = 22.34 S.D. = 8.29
Validation:	Not available
Reference:	Triezenberg, Henry J. "The Relative Effectiveness of Three Levels of Abstraction Representing the Conceptual Scheme of Equilibrium as an Advance Organizer in Teaching." Unpublished doctoral dissertation, University of Wisconsin, Madison, 1967, p. 316. University Microfilms Order No. 67-17040

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4. Zoology

Title:	ZOOLOGY FINAL
Factors:	Achievement in zoology content
Format:	75 matching and multiple-choice questions and three essay questions
Population:	10th grade biology students in Wausau, Wisconsin
Reliability:	Not available
Norms:	No overall mean or standard deviation given. N = 176
Validation:	Not available
Reference:	Aaron, Gnanaolivu. "The Effectiveness of Programmed Instruction When Used to Supplement or Supplant Assignments in Biology Classes in Which Team Teaching Techniques are Employed." Unpublished doctoral dissertation, University of Wisconsin, 1965, pp. 109-114. University Microfilms Order No. 65-5108

B. Earth Sciences

1. Earth Science

Title: EARTH SCIENCE ACHIEVEMENT TEST

Factors: Achievement in cognitive areas of traditional earth science course

Format: 75 multiple-choice items

Population: Ninth grade earth science students

Reliability: r = .83 (K-R 20) N = 1002

Norms: Means reported in dissertation

Validation: Items developed by earth science teachers. Trial with 121 earth science students provided item analysis information for final revision.

Reference: Agne, Russell M. "A Comparison of Earth Science Classes Taught by Using Original Data in a Research-Approach Technique Versus Classes Taught by Conventional Approaches Not Using Such Data." Unpublished doctoral dissertation, University of Connecticut, 1970.
University Microfilms Order No. 70-15,522

Title: STUDENT EARTH SCIENCE TEST

Factors: Earth science knowledge

Format: 40 multiple-choice items

Population: Junior high school students

Reliability: Not available

Norms: Not available

Validation: Items written and selected by science educators

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306 (John Thompson)

Title: 1) ACHIEVEMENT TEST
2) UNIT TESTS (4)

Factors: 1) Subject matter achievement (earth science)
2) Achievement in geology (2), meteorology, astronomy

Format: 60 multiple-choice items on each test

Population: Sophomore college students enrolled in physical science at SUNY College at Buffalo

Reliability: 1) r = .71 - .85 (K-R 20) N = 245
2) r = .70 - .82

Norms: 1) Post-test $\overline{X}$ = 29.64 (experimental)
2) Range $\overline{X}$ = 33.45 - 42.05 S.D. = 7.87 - 7.59
N = 119 (experimental)

Validation: Content validity determined by author

Reference: Young, Darrell Dean. "The Effects of Instruction Through Team Learning on Achievement in a General Education College Course in Physical Science." Unpublished doctoral dissertation, State University of New York at Buffalo, 1969, p. 60.
University Microfilms Order No. 69-15,195

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2. Anthropology

Title: EARLY MAN IN AMERICA

Factors: Achievement in facts and concepts concerning early man

Format: 60 multiple-choice items

Population: Eighth-grade earth science students

Reliability: r = .85 (K-R 20) N = 143

Norms: Not available

Validation: Not available

Reference: Thomas, Barbara S. "An Analysis of the Effects of Instructional Methods Upon Selected Outcomes of Instruction in an Interdisciplinary Science Unit." Unpublished doctoral dissertation, University of Iowa, Iowa City, 1968, pp. 147-155.
University Microfilms Order No. 68-16865

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3. Astronomy

Title: TRIAL TEST II

Factors: Achievement in the content of Chapter Four "Charting The Earth" from the text Charting the Universe developed by the Illinois Elementary School Science Project

Format: 55 multiple-choice items

Population: Sixth grade students

Reliability: r = .922 (Kuder-Richardson) N = 62

Norms: $\bar{X}$ = 26.0 S.D. = 11.7 N = 62

Validation: 93 item test administered to forty students who had completed Chapter Four. Difficulty level and internal validity of instrument determined by item analysis.

Reference: Eaton, Edward J. Jr. "An Investigation of the Relationship of Three Factors in Printed Materials to Achievement in Astronomy by Sixth Grade Students." Unpublished doctoral dissertation, University of Illinois, 1964, pp. 135-186. University Microfilms Order No. 65-3572

Title: CHARTING THE UNIVERSE TEST

Factors: Achievement of concepts presented by Elementary School Science Project materials

Format: 37 multiple-choice items and five problems

Population: Fifth grade students in a university laboratory school

Reliability: r = .829 (K-R 20) N = 92

Norms: $\bar{X}$ = 12.98 S.D. = 4.47 N = 90 (Post-test)

Validation: Not available

Reference: Klopfer, Leopold E. "An Evaluative Study of the Effectiveness and Effects of Astronomy Materials Prepared by the University of Illinois Elementary School Science Project." University of Chicago, Illinois, 1964.
ED 032 221 MF $0.65 HC $3.29 59 pp.

Title: ASTRONOMY TEST

Factors: Selected astronomy concepts

Format: 25 multiple-choice items

Population: Sixth grade students

Reliability: Not available

Norms: $\bar{X}$ = 14.21 S.D. = 4.34 N = 5,131

Validation: Not available

Reference: Smith, Billy Arthur. "An Experimental Comparison of Two Techniques (Planetarium Lecture-Demonstration and Classroom Lecture-Demonstration) of Teaching Selected Astronomical Concepts to Sixth Grade Students." Unpublished doctoral dissertation, Arizona State University, 1966, pp. 59-65.
University Microfilms Order No. 66-6906

Title: TEST ON ASTRONOMY FACTS

Factors: Knowledge of astronomy facts

Format: 30 multiple-choice items

Population: College students enrolled in a survey of physics course

Reliability: Not available

Norms: $\bar{X}$ = 19.5 and 21.4 N = 207

Validation: Content validity judged by author

Reference: Strope, Marvin B. "A Comparison of Factual and Conceptual Teaching in Introductory College Astronomy." Unpublished doctoral dissertation, Utah State University, Logan, 1966, pp. 45-54.
University Microfilms Order No. 65-13869

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4. Geology

Title:	GEOLOGICAL CONCEPTS TEST, GRADES 4, 5, 6
Factors:	Understanding of selected geological concepts
Format:	44 multiple-choice items
Population:	High and low achievers in grades four through six
Reliability:	r = .84 (K-R 20) N = 293
Norms:	Not available
Validation:	Jury established content validity
Reference:	Ashbaugh, Alexander C. "An Experimental Study For The Selection of Geological Concepts For Intermediate Grades." Unpublished doctoral dissertation, University of Georgia, 1964, pp. 94-103. University Microfilms Order No. 65-4483

C. Physical Science

1. Chemistry

Title: (None)

Factors: The level understanding of chemistry information;
1) Knowledge 2) Comprehension 3) Application
4) Analysis

Format: Reading passage followed by 45 multiple-choice items

Population: Students enrolled in high school chemistry

Reliability: Not available

Norms: Listed on pp. 32-42 of dissertation (N's = 230 and 408)

Validation: Selection of items from Dressel and Nelson, Questions and Problems in Science -- Test Folio No. 1; additional items developed by investigator. Reading passage and items submitted to panels of judges.

Reference: Anderson, June S. "A Comparative Study of Chemical Educational Material Study and Traditional Chemistry in Terms of Students' Ability to Use Selected Cognitive Processes." Unpublished doctoral dissertation, Florida State University, 1964, pp. 54-66.
University Microfilms Order No. 65-0309

Title: ACHIEVEMENT TESTS ON NUCLEAR CHEMISTRY

Factors: Two tests, each assesses achievement in nuclear chemistry

Format: 44 multiple-choice items

Population: High school chemistry students

Reliability: r = .841 and .882 (K-R 20) N = 638

Norms: Not available

Validation: Face validity determined by five-member jury

Reference: Darnowski, Vincent S. "Three Types of Programmed Learning and the Conventional Teaching of the Nuclear Chemistry portion of the High School Chemistry Course." Unpublished doctoral dissertation, New York University, New York, 1968, p. 353.
University Microfilms Order No. 68-11785

Title: MATHEMATICS SKILL TEST IN CHEMISTRY

Factors: Measures student performance at three cognitive levels on ten basic mathematics skills: computation, signed numbers, use of parentheses, fractions, decimals, exponents, percent, one-variable equations, ratio and proportions, and graphing.

Format: 60 multiple-choice items

Population: High school chemistry students

Reliability: r = .963 (K-R 20) N = 272

Norms: $\bar{X}$ = 24.83 S.D. = 16.36 S.E. = .77 N = 272

Validation: Judgemental validity by jury and item analysis. Concurrent validity by comparison with 1969 American Chemical Society High School Chemistry test (r = .799)

Reference: Rita T. Denny
Graduate School of Education
University of Pennsylvania
37th & Walnut Street
Philadelphia, Penn. 19104

Title: ONTARIO TEST OF ACHIEVEMENT IN CHEMISTRY

Factors: Achievement of cognitive objectives of knowledge, comprehension, application and analysis in chemistry

Format: Sixty multiple-choice items

Population: 12th grade chemistry students in college preparatory program of Ontario high schools

Reliability: r = .819 (K-R 20) N = 2339

Norms: $\bar{X}$ = 25.15 S.D. = 8.13 N = 2339

Validation: Not available

Reference: Even, Alexander. "Patterns of Academic Achievement in Grade 12 Chemistry and Their Relationship to Personal, Attitudinal and Environmental Factors." Toronto University, (Ontario) 1968, pp. 291-333.
ED 040 850 MF $0.65 HC $16.45 421 pp.

Title: G 3B

Factors: Content achievement in general chemistry

Format: 100 multiple-choice items

Population: First quarter college chemistry students

Reliability: r = .84 (K-R 20) N = 120

Norms: $\bar{X}$ = 37.64 S.D. 14.48 N = 701

Validation: Three member jury of professional chemists

Reference: Ledbetter, J. C. "The Effects of Instrumentation of Freshman Chemistry Laboratory on Achievement and Interest in Chemistry." Unpublished doctoral dissertation, Georgia University, Athens, 1969, pp. 232-264.
University Microfilms Order No. 70-1176

Title: (None)

Factors: Subject matter achievement in chemistry

Format: 30 multiple-choice items

Population: Students in secondary schools in Beirut, Lebanon

Reliability: Not available

Norms: $\bar{X}$ = 17.08 N = 22

Validation: CHEM Study achievement tests used as guide in development. Results of trial submitted to three-person panel for revision.

Reference: Namek, Yakub Rizkallah. "The Effect of Integrated Laboratory Work on Achievement in Secondary School Chemistry." Unpublished doctoral dissertation, The University of Wisconsin, 1968, pp. 153-166.
University Microfilms Order No. 68-5339

Title: GENERAL CHEMISTRY EXAMINATION

Factors: Achievement and problem-solving ability in chemistry

Format: 70 true-false items and 10 multiple-choice items

Population: College general chemistry students

Reliability: r = .72 (Split-halves technique using Spearman-Brown correction formula) N = 149

Norms: Experimental group: $\bar{X}$ = 32.81 S.E. = .85 N = 73

Validation: Content validity estimated from normal distribution of test scores, examination of test by author and two chemistry professors and correlation with American Chemical Society Problem-Solving Examination.

Reference: Riggs, Virgil M. "A Comparison of Two Methods of Teaching College General Chemistry Laboratory." Unpublished doctoral dissertation, Oklahoma State University, 1961, pp. 138-147. University Microfilms Order No. 62-1620

Title: (SEVEN TESTS INCLUDING PRETEST, MIDTERMS AND FINAL ON CHEMISTRY)

Factors: Application of chemical concepts

Format: 25 to 40 items; multiple-choice or true-false

Population: High school chemistry students, not science oriented, probably not college-bound

Reliability: r = .66 (Test-retest of two of the instruments using Pearson Product-Moment Correlation) N = 20

Norms: $\bar{X}$ = 26 (out of 40 items) S.D. = 5.42
final exam, experimental group

Validation: Not available

Reference: Walton, George. "A Small Project Research Proposal in Secondary School Science Education." Western New Mexico University, Silver City, 1968. Tests at end of document.
ED 023 614 MF $0.65 HC $13.16 391 pp.

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2. Physics

Title: MATHEMATICS-PHYSICS SURVEY EXAMINATION

Factors: The use of mathematical skills in solving physics problems; 1) linear equations 2) inverse equations
3) inverse square equations 4) vector solution
5) equations involving trigonometric relations
6) graph interpretation 7) standard notation
8) simultaneous equations

Format: Section A: 20 physics problems involving the use of mathematical skills
Section B: 20 similar problems with appropriate formula following each item
Section C: 15 mathematical problems involving skills required in Sections A and B.

Population: Secondary school physics students in New York State schools

Reliability: r = .756 (Spearman-Brown using Split-half technique)
N = 56

Norms:

A.	$\bar{X}$ = 14.848	S.D. = 3.562	
B.	$\bar{X}$ = 16.036	S.D. = 3.257	N = 362
C.	$\bar{X}$ = 13.420	S.D. = 1.370	

Validation: Content validity established by five person jury

Reference: Abeles, Sigmund. "The Utilization of Certain Mathematical Skills in the Solution of Selected Problems in Physics." Unpublished doctoral dissertation, New York University, 1966, p. 168.
University Microfilms Order No. 67-107

Title: (FOUR "COLLEGE TESTS")

Factors: Achievement in physics

Format: 40 to 45 multiple-choice items in each test

Population: College physics students

Reliability: r = .87 to .92 (Split-halves method using Spearman-Brown Prophecy Formula)

Norms: Not available

Validation: Not available

Reference: Abrams, Leonard S. "A Comparison of the Teaching Effectiveness of Some Methods of On-Campus Supplementation of the Telecourse Atomic Age Physics." Unpublished doctoral dissertation, New York University, 1958, pp. 115-126.
University Microfilms Order No. 62-1459

Title: THEORY TEST IN PHYSICS

Factors: Knowledge of facts, principles and generalizations of physics

Format: Item types include multiple-choice, completion and true-false

Population: Students enrolled in a one-semester terminal physics course at Wisconsin State College in Stevens Point

Reliability: Split-half (Spearman-Brown) r = .88 N = 49

Norms: $\overline{X}$ = 69.35 S.D. = 11.13

Validation: Not available

Reference: Bainter, Monica E. "A Study of the Outcomes of Two Types of Laboratory Techniques Used in a Course in General College Physics for Students Planning to be Teachers in the Elementary Grades." Unpublished doctoral dissertation. The University of Wisconsin, 1955, p. 248.
University Microfilms Order No. 14,680

Title: LABORATORY PERFORMANCE AND LABORATORY THEORY TEST

Factors: Knowledge of facts, generalization and principles of physics. Two factors identified; theory and performance.

Format: Practical examination with variable format including multiple-choice items

Population: Students enrolled in a terminal one-semester physics course at Wisconsin State College at Stevens Point

Reliability: Theory r = .73 Split-half technique using Spearman-Brown Correlation formula
Performance r = .54 N = 49

Norms: Theory $\overline{X}$ = 23.25 r = 4.14 N = 49
Performance $\overline{X}$ = 23.22 r = 5.12

Validation: Not available

Reference: Bainter, Monica E. "A Study of the Outcomes of Two Types of Laboratory Techniques Used in a Course in General College Physics for Students Planning to be Teachers in the Elementary Grades." Unpublished doctoral dissertation, The University of Wisconsin, 1955, p. 259.
University Microfilms Order No. 14,680

Title: A TEST OF ABILITY TO IDENTIFY AND APPLY SELECTED PRINCIPLES OF PHYSICS

Factors: See Title

Format: Part I: For each of 19 items a principle is stated followed by an event or phenomenon (situation). Student selects the one of four responses which represents the correct application of the principle.
Part II: Situation is described, student selects principle which is the major cause or explanation for the situation.

Population: 12th grade students

Reliability: Part I; r = .637 (K-R 20) Part II; r = .719 (K-R 20)
N = 4434

Norms: Part I; $\overline{X}$ = 8.5 (19 items)
Part II; $\overline{X}$ = 10 (17 items)

Validation: Content validity determined by panel of judges

Reference: Brian J. Kearney
Slippery Rock State College
Slippery Rock, Pa. 16057

Title: PHYSICS TEST I

Factors: Recall, recognition and understanding of physics content

Format: 40 multiple-choice items

Population: College freshman

Reliability: r = .743 (Split-halves method using Spearman-Brown formula)
N = 211

Norms: Not available

Validation: Content validity by jury. Concurrent validity by comparison with standardized test results and teacher grades.

Reference: Sandler, Barney. "A Comparison of an Integrated Course in College Physics and Mathematics of the Semester Duration with Separate Courses in the Two Subjects in a Two Year Community College." Unpublished doctoral dissertation, New York University, 1961, p. 82.
University Microfilms Order No. 62-1429

Title: MECHANICS ACHIEVEMENT EXAMINATION

Factors: Achievement in mechanics; used as a predictor of success in physics

Format: 50 multiple-choice items

Population: Eleventh graders at Bronx High School of Science

Reliability: r = .87 (K-R 20) N = 127

Norms: $\overline{X}$ = 60.968 N = 124

Validation: Item analysis of entire item pool produced indices of discrimination and difficulty. Items for final test form were selected from those close to the 50% level of difficulty and exceeding 0.20 in discrimination. This form was then modified on the basis of a second item analysis and jury recommendations.

Reference: Vandecker, Louis. "The Effect of Delayed-Response Learning Guides and Immediate Response Teaching Tests on Achievement in Mechanics." Unpublished doctoral dissertation, New York University, 1968, pp. 161-171.
University Microfilms Order No. 69-21,192

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3. General Physical Science

Title: THE TEST OF ELECTROSTATICS CONCEPTS

Factors: Achievement in additive and multiplicative classification, seriation and electrostatics concepts

Format: Practical test with 30 Piagetian-like tasks

Population: Third grade students from high socioeconomic area

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Bridgham, Robert G. "Classification, Seriation, and The Learning of Electrostatics." Journal of Research in Science Teaching, Vol. 6, pp. 118-127, 1969.

Title: ELECTRICITY AND MAGNETISM

Factors: Understanding of concepts presented in problem-solving situations

Format:	102 multiple-choice items matching ink drawings to vocabulary items
Population:	Fifth and sixth grade students
Reliability:	r = .90 (Split-halves method using Pearson product-moment)
Norms:	$\overline{X}$ = 62.9 to 67.0
Validation:	Face validity established by four-member jury
Reference:	Brudzynski, Alfred John. "A Comparative Study of Two Methods for Teaching Electricity and Magnetism With Fifth and Sixth Grade Children." Unpublished doctoral dissertation, Boston University, 1966, pp. 174-184. University Microfilms Order No. 66-14766

Title:	(None)
Factors:	Application of concepts included in the topic "Light"
Format:	26 situation-based multiple-choice items
Population:	Secondary school students in the country of Tanzania
Reliability:	r = .81 (odd-even split-half technique) N = 162
Norms:	Not available - administered to over 500 students
Validation:	Five-member panel of judges
Reference:	Cannon, George H. "Relationships of Certain Characteristics of African Learners to Achievement in Programmed Instruction." Unpublished doctoral dissertation, Washington State University, 1968, p. 85. University Microfilms Order No. 68-10,949

Title:	PHYSICAL SCIENCE TEST OVER HEAT AND TEMPERATURE
Factors:	Understanding and application of knowledge about heat and temperature
Format:	60 multiple-choice items
Population:	Eighth grade students enrolled in physical science classes
Reliability:	Reliability coefficient of 88.6 computed from results of test administration to 110 ninth grade students.

Norms: $\bar{X}$ = 41.00 (post test) N = 96

Validation: Items selected from a variety of materials by two teachers and the researcher

Reference: Clark, Billy M. "An Experiment in Cultivating Creative Thinking Abilities in the Classroom." Unpublished doctoral dissertation, Iowa State University, 1968, pp. 85-92. University Microfilms Order No. 68-14,778

Title: (INDIVIDUAL TEST ITEMS)

Factors: Test items were developed related to 25 selected concepts from the scheme, "the particle nature of matter."

Format: Items were of alternate response pictorial type, presented via motion picture film. Five items were developed for each concept. The verbal part of each question was read aloud while student viewed the written question and picture on the screen and in test booklets.

Population: Each item used at all grade levels 2-6

Testing of items: 104 of 125 items developed met at least 4 or 6 criteria established for judging the quality of items

Validation: Items designed to reduce demand on reading and verbal ability of students

Reference: Doran, Rodney Lee. "Development of Test Items Related to Selected Concepts Within the Scheme the Particle Nature of Matter." Unpublished doctoral dissertation, University of Wisconsin, 1969, pp. 29-139. University Microfilms Order No. 70-3515

Title: SEVENTH GRADE MATTER FINAL

Factors: Achievement of facts and concepts of matter

Format: 50 multiple-choice items

Population: Seventh grade students of a university school

Reliability: r = .70 (Kuder-Richardson) N = 54

Norms: $\bar{X}$ = 23.09 S.D. 2.96 N = 54

Validation: Face validity

Reference: James, Robert K. "A Comparison of Group and Individualized Instructional Techniques in Seventh Grade Science." Unpublished doctoral dissertation, University of Iowa, Iowa City, 1969, pp. 108-118.
University Microfilms Order No. 69-21,698

Title: NONE

Factors: Achievement in elementary atomic structure

Format: 30 multiple-choice items

Population: Eighth-grade general science students of middle class background

Reliability: r = .73 (K-R 20) N = 769

Norms: Not available

Validation: Eight member jury of chemical educators

Reference: Knorr, Sheldon H. "A Charge Cloud Atomic Model for Junior High School Students." Unpublished doctoral dissertation, University of Maryland, College Park, 1967, pp. 184-190.
University Microfilms Order No. 68-6533

Title: A TEST OF GENERAL PHYSICAL SCIENCE

Factors: Achievement in physical science course content; Knowledge of facts, concepts and principles.

Format: 50 multiple-choice items (two forms)

Population: Elementary education majors in Massachusetts State Teachers Colleges

Reliability: Several methods used yielded reliabilities on post-test ranging between .63 and .87.

Norms: $\bar{X}$ = 40.34 (post-test) S.D. 11.56 N = 884

Validation: Validation procedures used included; jury ratings of items, and the index of discrimination on items between high scorers and low scorers.

Reference: Malone, William Howard. "The Construction and Use of a Test of Physical Science as it is Offered in the State Teachers Colleges of Massachusetts." Unpublished doctoral dissertation, Boston University, 1959, p. 126.
University Microfilms Order No. 60-313

Title: MATTER, ATOMS, AND MOLECULES

Factors: Recall and application of content - from a unit in matter, atoms and molecules

Format: 60 multiple-choice items split between two subtests; recall and application

Population: Ninth grade physical science students

Reliability: r = .936 (K-R 20) N = 547

Norms: Means for three treatment groups ranged from 35.06 - 38.62

Validation: Three-member jury

Reference: McKee, Ronald J. "A Comparative Study of Two Programmed Instructional Methods and Conventional Instruction in a Unit of Nint h Grade Physical Science." Unpublished doctoral dissertation, University of North Dakota, Grand Forks, 1966, p. 92.
University Microfilms Order No. 67-4466

Title: UNIT TEST - MACHINES

Factors: Content achievement in facts and concepts concerning machines

Format: 65 multiple-choice items

Population: 4th, 5th and 6th grade students

Reliability: Experimental groups: r = 0.84 (Kuder-Richardson "rational equivalance" method) N = 60 in each group

Norms: Post-test experimental groups: $\bar{X}$ (4th grade) = 35.08
$\bar{X}$ (5th grade) = 38.70
$\bar{X}$ (6th grade) = 42.85

Validation: 14-member jury established content validity

Reference: Pershern, Frank R. "The Effect of Industrial Arts Activities on Science Achievement and Pupil Attitudes in the Upper Elementary Grades." Unpublished doctoral dissertation, Texas A & M University, College Station, 1967, pp. 126-149.
University Microfilms Order No. 68-9802

Title: UNIT TEST - ELECTRICITY

Factors: Content achievement in facts and roots concerning electricity

Format: 65 multiple-choice items

Population: 4th, 5th and 6th grade students

Reliability: Experimental groups: r = 0.84 (Kuder-Richardson "rational equivalance" method) N = 60

Norms: Post-test experimental group, 6th grade $\overline{X}$ = 45.95

Validation: 14-member jury established content validity

Reference: Pershern, Frank R. "The Effect of Industrial Arts Activities on Science Achievement and Pupil Attitudes in the Upper Elementary Grades." Unpublished doctoral dissertation, Texas A & M University, College Station, 1967, pp. 126-149.
University Microfilms Order No. 68-9802

Title: PHYSICAL SCIENCE SUBJECT MATTER TEST

Factors: Knowledge of facts and principles in physical science

Format: 59 multiple-choice items

Population: College sophomores enrolled in physical science

Reliability: r = .85 split-half technique using Spearman-Brown correlation

Norms: $\overline{X}$ = 33.75 S.E. 3.62 N = 362

Validation: Author selected and developed items with reference to course content. Two course instructors reviewed items for content validity, accuracy and clarity.

Reference: Zingaro, Joseph S. "An Experimental Comparison Between Two Methods of Teaching College Sophomores The Inter-Relationship of Physicochemical Principles in Physical Science." Unpublished doctoral dissertation, Syracuse University, 1965, pp. 50-80.
University Microfilms Order No. 66-9873

D. Instruments Not Specific To A Science Area

1. College Level

Title: PHYSICAL SCIENCE 114 LABORATORY EXAMINATION

Factors: Achievement in general science topics

Format: 27 multiple-choice items and one short answer problem

Population: Freshman and sophomore college non-science majors

Reliability: r = .64 (K-R 20) N = 60

Norms: Not available

Validation: Determination of internal consistency

Reference: Appleman, Ronald E. "A Comparative Study of the Cognitive Effects of the Use of Take Home Laboratory Materials on Student Achievement in College Level Physical Science Classes." Unpublished doctoral dissertation, Oklahoma State University, 1967, p. 52.
University Microfilms Order No. 68-8692

Title: SCIENCE FROM CONCEPTS ACHIEVEMENT TEST

Factors: Measures knowledge of principles and generalizations, comprehension, interpretation, and application. Content areas represented in elementary science textbooks and series.

Format: 64 multiple-choice items

Population: College students

Reliability: r = .723 (K-R 20) N = 215

Norms: Not available

Validation: Content validation by jury

Reference: H. Gene Christman
The University of Akron
Science Education Center
Akron, Ohio 44304

Title: GENERAL SCIENCE KNOWLEDGE

Factors: Knowledge of general science concepts

Format: 30 multiple-choice items. Respondent indicates his degree of certainty that he has selected the correct response.

Population: Students in professional education classes

Reliability: r = 0.680 (K-R 20) N = 60

Norms: $\bar{X}$ = 7.02 S.D. = 2.73 N = 60

Validation: Not available

Reference: Gilman, David A. "A Comparison of the Effectiveness of Feedback Modes for Teaching Science Concepts by Means of a Computer-Assisted Adjunct Auto-Instruction Program." Unpublished doctoral dissertation, The Pennsylvania State University, 1967, pp. 109-116.
University Microfilms Order No. 68-8692

Title: FINAL EXAMINATION

Factors: Achievement in diverse science topics

Format: Completion, multiple-choice and essay items. (2 forms)

Population: College non-science majors

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Leader, William. "The Expressed Science Interests of Students at the Conclusion of a College Science Survey Course and Their Relationship to Achievement in the Course." Unpublished doctoral dissertation, Columbia University, 1951, pp. 81-98.
University Microfilms Order No. 3357

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2. Secondary Level

Title: PORTLAND SCIENCE TEST

Factors: Knowledge of products of science and understanding and ability to use processes of science

Format: 60 multiple-choice items in product-process pairs

Population: Eighth grade students in Portland from a variety of backgrounds

Reliability: r = 0.85 (Garrett rational equivalence method) N = 515

Norms:

Experimental group		N = 262
Process	$\bar{X}$ = 16.2	S.D. = 4.65
Product	$\bar{X}$ = 16.6	S.D. = 5.50
Total	$\bar{X}$ = 32.8	S.D. = 9.59

Validation: Jury of all Portland ninth grade science teachers

Reference: Hutchinson, John S. "Automated Science Curriculum: An Experimental Science Program" Unpublished doctoral dissertation, Oregon State University, Corvallis, 1966, pp. 123-160.
University Microfilms Order No. 67-716

Title: SCIENCE SKILLS TEST

Factors: Spelling, vocabulary, reading comprehension and total achievement in science

Format: 70 to 100 multiple-choice items in each of four sub-tests

Population: Eighth grade biology students

Reliability: r = .73 to .94 (Split halves on sub-tests) N = 166

Norms: Not available

Validation: Not available

Reference: Jones, John L. "Effects of Spelling Instruction in Eighth-Grade Biological Science Upon Scientific Spelling, Vocabulary, and Reading Comprehension; General Spelling, Vocabulary, and Reading Comprehension: Science Progress: and Science Achievement." Unpublished doctoral dissertation, University of Maryland, College Park, 1966, pp. 67-120.
University Microfilms Order No. 67-6121

Title: TEACHER-MADE SUBJECT-MATTER TESTS

Factors: Content achievement in general science;
1) Living things
2) Simple machines
3) Airplanes
4) Electricity and Magnetism
5) Chemistry
6) Geology

Format: Completion, multiple-choice and true-false items; the six tests total 215 items

Population: Eighth grade students

Reliability: Method not reported

1) r = .70 4) r = .55
2) r = .76 5) r = .91 N = 56
3) r = .57 6) r = .84

Norms:
1) $\overline{X}$ = 23.59 S.D. = 5.47
2) $\overline{X}$ = 11.98 S.D. = 4.24
3) $\overline{X}$ = 19.54 S.D. = 3.22 N = 56
4) $\overline{X}$ = 21.37 S.D. = 3.70
5) $\overline{X}$ = 28.35 S.D. =12.50
6) $\overline{X}$ = 29.07 S.D. = 8.15

Validation: Validity indices range from .74 to .95 on subtests. Method of determination not given.

Reference: Jones, Kenneth W. "A Comparison of Two Methods of Teaching Eighth Grade General Science: Traditional and Structured Problem Solving." Unpublished doctoral dissertation, The University of Arizona, 1966, p. 126.
University Microfilms Order No. 66-10201

Title: JUNIOR HIGH SCIENCE ACHIEVEMENT TEST

Factors: Achievement of science vocabulary

Format: 116 matching and discrimination items

Population: Ninth grade science students from suburban schools

Reliability: r = .889 (Split halves technique using Spearman-Brown formula) N = 593

Norms: $\overline{X}$ = 65.50 S.D. = 13.54 N = 593

Validation: Correlations with: Read General Science Test .740; Teacher grades .615; Terman-McNemar Test of Mental Ability .606.

Reference: Lazow, Alfred. "The Construction of a Junior High Science Achievement Test Based on a Vocabulary Selected From Current Science Textbooks." Unpublished doctoral dissertation, Boston University School of Education, Massachusetts, 1964, pp. 104-122.
University Microfilms Order No. 65-5531

Title: QUALITY CONCEPT INVENTORY OF TWENTY SELECTED SCIENCE WORDS

Factors: Level of comprehension of the twenty science words expressing concepts having various degrees of complexity

Format: Two forms, senior high school and junior high school. Both contain three true statements on each of twenty words. For each statement respondents are asked to indicate agreement, disagreement or indecision. (Part I) Respondents are then asked to rank each of the three statements associated with a word according to their importance. (Part II)

Population: Junior and senior high school children in Colorado schools

Reliability: Part I: r = .83 (junior high form) and .80 (senior high form) K-R 20

Part II: reliability coefficients for average rankings ranged above .88 except for one word on junior high form.

Norms: Not available. Given to 5,713 students.

Validation: Jury assessed validity of statement and ranked them according to complexity. Reliability coefficient for rankings ranged above .90 on all 20 sets of statements.

Reference: Shoemaker, Joseph Leslie. "A Study of the Differences of Comprehension that Pupils in Colorado Secondary Schools Have of Twenty Selected Science Words." Unpublished doctoral dissertation, University of Colorado, 1963, pp. 150-166.
University Microfilms Order No. 64-1943

Title: PRETEST

Factors: Knowledge and understanding of the concept of equilibrium; ability to use concept as a first level cognitive "organizer".

Format: Single response, four-choice objective style, 54 items

Population: Seventh and ninth grade students

Reliability: r = .60 (Analysis of variance)

Norms: $\overline{X}$ = 19.14 S.D. = 5.2

Validation: Not available

Reference: Triezenberg, Henry J. "The Relative Effectiveness of Three Levels of Abstraction Representing the Conceptual Scheme of Equilibrium as an Advance Organizer in Teaching." Unpublished doctoral dissertation, University of Wisconsin, Madison, 1967, p. 304.
University Microfilms Order No. 67-17040

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3. Elementary Level

Title: PICTURE TEST FOR COMPREHENSION OF SCIENCE CONCEPTS
(One test for each of three grade levels)

Factors: Achievement in science concepts

Format: Picture and word description of 15 problem situations
Student selects one of three pictures he feels represents a correct result.

Population: Urban kindergarten, first, and second grade children classed as non-readers

Reliability: Not available

Norms: Not available

Validation: Content validity judged by author and "experts"

Reference: Boener, Charlotte M. "An Evaluation of the Grade Placement of Science Concepts in the Early Elementary Grades of the Minneapolis Public Schools." Unpublished doctoral dissertation, State University of Iowa, 1965, pp. 56-187.
University Microfilms Order No. 66-3411

Title: PICTORIAL-AURAL INVENTORY OF SCIENCE KNOWLEDGE

Factors: Achievement in science knowledge

Format: 60 picture multiple-choice items

Population: Fifth grade students

Reliability: r = .73 (Split halves method using Spearman-Brown Prophecy Formula) N = 300

Norms: Not available

Validation: Four-member jury

Reference: Finkelstein, Leonard B. "The Development of a "Reading Free" Testing Procedure for the Evaluation of Knowledge and Understandings in Elementary School Science." Unpublished doctoral dissertation, Temple University, Philadelphia, 1967, pp. 127-172.
University Microfilms Order No. 68-4505

Title: READING INVENTORY OF SCIENCE KNOWLEDGE

Factors: Achievement of science knowledge

Format: 60 multiple-choice items

Population: Fifth grade students

Reliability: r = .86 (Split halves method using Spearman-Brown Prophecy Formula) N = 360

Norms: Not available

Validation: Four-member jury

Reference: Finkelstein, Leonard B. "The Development of a "Reading Free" Testing Procedure for the Evaluation of Knowledge and Understandings in Elementary School Science." Unpublished doctoral dissertation, Temple University, Philadelphia, 1967, pp. 122-126.
University Microfilms Order No. 68-4505

Title: PICTURE TESTS AND OBJECT IDENTIFICATION TESTS

Factors: Identification of scientific knowledge held by entering kindergarten students

Format: Picture test, interviews and object identification test used in a verbal testing situation

Population: Entering kindergarten students in Shaker Heights, Ohio

Reliability: Not available

Norms: See dissertation starting on page 88

Validation: Test based on content analysis of four elementary science textbooks

Reference: Helfrich, John E. "A Descriptive Study of Certain Science Learnings Known by Entering Kindergarten Students." Unpublished doctoral dissertation, Wayne State University, 1963, p. 141.
University Microfilms Order No. 64-5100

Title: 1) KNOWLEDGE 2) COMPREHENSION 3) APPLICATION

Factors: Achievement in understanding certain concepts at the knowledge, comprehension and application levels

Format: 40 multiple-choice items

Population: Second through sixth grade students

Reliability: Internal consistency reliability determined through use of Hoyt Analysis of Variance
1) .80 2) .74 3) .75 Total = .90

Norms: Listed by concept and level in dissertation

Validation: Content validity assessed by jury

Reference: Helgeson, Stanley L. "An Investigation into the Relationships Between Concepts of Force Attained and Maturity as Indicated By Grade Levels." Unpublished doctoral dissertation, University of Wisconsin, Madison, 1967, p. 146.
University Microfilms Order No. 67-16956

Title: QUALITY CONCEPT INVENTORY OF TWENTY SELECTED SCIENCE WORDS

Factors: Levels of comprehension of twenty science words

Format: Two forms; primary for grades K-3, intermediate for grades 4-6.
Primary: Respondent identified most important of three statements associated with each word.
Intermediate: Respondent assessed the correctness of each statement and ranked them in order of importance.

Population: Children in grades K through six in Colorado schools

Reliability: Determined in pilot studies, but not reported

Norms: Not available. Given to 6,447 students

Validation: 48-member jury assessed validity of statements and ranked them according to complexity. Reliability coefficient for rankings ranged from .91 to .99 for the 20 sets of statements.

Reference: Kerns, LeRoy Raymond. "A Study of the Differences of Comprehension that Pupils in Colorado Elementary Schools Have of Twenty Selected Science Words." Unpublished doctoral dissertation, University of Colorado, 1963, pp. 233-253. University Microfilms Order No. 64-1927

Title: (None)

Factors: Achievement in science

Format: 40 multiple-choice items

Population: Fifth and sixth grade students

Reliability: Spearman-Brown split half correlation;
6th grades = .87 5th grades = .85 N = 2934

Norms: $\overline{X}$ = 15.31 to 17.60 S.E. = .13 - .17 N = 2934

Validation: Six-member jury

Reference: McBride, Richard E. "The Effect of an In-Service Science Training Program for Teachers on the Achievement of Elementary School Children." Unpublished doctoral dissertation, Cornell University, Ithaca, New York, 1967, pp. 94-105. University Microfilms Order No. 67-12623

Title: PRE-TEST, CRITERION TEST A, CRITERION TEST B

Factors: Knowledge comprehension and application of selected science concepts

Format: 35 to 40 multiple-choice items

Population: Sixth grade pupils

Reliability: Kuder-Richardson internal consistency formula used to establish reliabilities of .64 to .71.
N = 186 - 190

Norms: $\bar{X}$ = 19.82 - 20.27 S.E. = 2.57 - 2.83 N = 186 - 190

Validation: Not available

Reference: Schulz, Richard W. "The Role of Cognitive Organizers in the Facilitation of Concept Learning in Elementary School Science." Unpublished doctoral dissertation, Purdue University, Lafayette, Indiana, 1966, pp. 143-171.
University Microfilms Order No. 67-5495

Title: SCIENCE CONCEPT TEST (PCE); Detroit Edition

Factors: Understanding of selected science concepts

Format: Seven pictorial representatives of a science concept; Each is followed by three multiple choice items

Population: Ten and eleven year old children enrolled in Detroit elementary schools

Reliability: Not available

Norms: Not available

Validation: Two groups of students were identified; those that scored well on certain concepts and those that scored poorly on the same concepts. These students were interviewed by teachers who evaluated their understanding of the same concepts. The hypothesis that no relationship existed between PCE results and teacher assessment of students understanding could be rejected.

Reference: Scott, Norval C. Jr. "The Relationship of Inductive Reasoning and Cognitive Styles in Categorization Behavior to Science Concept Achievement in Elementary School Children." Unpublished doctoral dissertation, Wayne State University, 1962, pp. 171-193.
University Microfilms Order No. 63-2223

Title: (None)

Factors: Achievement of the behavioral objectives of the following units: 1) Seeds, 2) Classification, 3) Temperature, 4) Time, 5) Water, 6) Energy

Format: Oral examination

Population: 1 and 2 ----------First Graders
3 and 4 ----------Third Graders
5 and 6 ----------Sixth Graders

Reliability: Not available

Norms: 1 and 2 N = 160 No Means, etc. given
3 and 4 N = 192
5 and 6 N = 190

Validation: Not established

Reference: Smith, George F. "A Study of the Effects on Student Achievement in Elementary Science Programs Resulting From Teacher In-Service Training and Additional Instructional Aids." Final Report Project #8-B-020, Office of Education, June, 1969, pp. 145-158.
ED 041 762 MF $0.65 HC $6.58 167 pp.

Title: LESSON TESTS

Factors: Knowledge, comprehension, application of selected science concepts

Format: Eleven tests of 36 "yes-no items" each

Population: Pupils from grades 2-6 of heterogeneous socioeconomic grouping

Reliability: Range from .44 to .85 N = 100

Norms: Not available

Validation: Not available

Reference: Stauss, Nyles G. "An Investigation Into The Relationship Between Concept Attainment and Level of Maturity." Unpublished doctoral dissertation, University of Wisconsin, Madison, 1967, pp. 239-279.
University Microfilms Order No. 67-17030

II. ACHIEVEMENT IN PROCESSES AND SKILLS OF SCIENCE

Title: BASIC SCIENCE PROCESSES TEST

Factors: Achievement in science processes as defined by AAAS

Format: Slides and correlated audio-tapes

Population: First through third graders from agriculturally oriented community

Reliability: r = .353 - .711 (Test-retest) N = 854

Norms: Not available

Validation: Not available

Reference: Beard, Jean. "Group Achievement Tests Developed For Two Basic Processes of AAAS (American Association for the Advancement of Science) Science -- A Process Approach." Unpublished doctoral dissertation, Oregon State University, Corvallis, 1970.
Available from: William Jasper Kerr Library, Oregon State University, Corvallis, Oregon 97331.

Title: X - 35 TEST OF PROBLEM SOLVING

Factors: Identification of the following behaviors considered to be part of the practice of science: 1) Early formation of hypothesis; 2) Specific experimentation with relevant variables as contrasted to random guessing; 3) Introduction of control to test the validity of a hypothesis selected; 4) Specific attempts at verification of the hypothesis.

Format: The instrument presents the respondent with 1) a specific problem, 2) data he might employ in solving the problems, 3) a list of possible solutions including the correct one. Responses judged on a scale of 1 to 5 with reference to the four criteria quoted above.

Population: College students

Reliability: Comparison of individual scores in the two problems of the instrument yielded a reliability coefficient of .54.

Norms: Not available

Validation: Construct validity with reference to a defined model of problem solving behavior. Agreement between evaluations of investigator and judges on the three parts ranged from .62 to .87.

Reference: Butts, David P. "The Evaluation of Problem Solving in Science." Journal of Research in Science Teaching, Vol. 2, pp. 116-122, 1964.

Title: TEST OF UNDERSTANDING OF THE ELEMENTS OF MODEL BUILDING

Factors: Level of understanding of model building

Format: 48 multiple-choice items

Population: Eighth grade science students

Reliability: r = .31 to .71 (K-R 20) N = 817

Norms: $\overline{X}$ = 23.08 and 19.93 S.D. = 6.85 and 6.25 (Post-test)

Validation: Face validity determined by 7-member jury

Reference: Devito, Alfred. "The Contribution of Certain Science Investigations to the Understanding of the Elements of Scientific Model Building by General Science Students Enrolled in a Three-Track Curriculum." Unpublished doctoral dissertation, University of Texas, Austin, 1966, pp. 191-203.
University Microfilms Order No. 66-14,369

Title: CONCEPT-PROCESS TEST

Factors: Understanding of scientific concepts and processes. Test designed to be used in assessing these factors in classes representing all the commonly taught secondary science curriculums.

Format: 38 multiple-choice items subdivided into concept and process subscales

Population: Science students in grades 6 through 12 in schools of central Ohio

Reliability: Total r = 0.835 K-R 20 N = 1399
Concept r = 0.655
Process r = 0.802

Norms: Total $\bar{X}$ = 18.22 S.D. = 3.15 (38 items) N = 1399
Concept $\bar{X}$ = 9.69 S.D. = 3.51 (20 items)
Process $\bar{X}$ = 8.54 S.D. = 4.25 (18 items)

Validation: Jury evaluation of items in item pool with reference to the publication Theory into Action in Science Curriculum Development, Washington: NSTA, 1964. Item analysis from preliminary testing of items used in selecting those on final form of instrument.

Reference: Disinger, John A. "Student Development, Teacher Characteristics, and Class Characteristics." Unpublished doctoral dissertation, The Ohio State University, 1971, pp. 212-225.
University Microfilms Order No. 72-4470

Title: COMBINATIONAL PROBLEM SET

Factors: Combinational skill in mathematics and general science

Format: Ten problems

Population: Sixth grade students in middle class, suburban area

Reliability: r = .8109 (Test-retest method using Pearson r correlation)
N = 32

Norms: Not available

Validation: Eight-member jury

Reference: Dyril, Odvard E. "An Investigation Into the Development of Combinatorial Mechanisms Characteristic of Formal Reasoning, Through Experimental Problem Situations With Sixth-Grade Students." Unpublished doctoral dissertation, Indiana University, Bloomington, 1967, pp. 105-112.
University Microfilms Order No. 68-4717

Title: SEVENTH GRADE MATTER SKILLS TEST

Factors: Science laboratory skills

Format: Practical

Population: Seventh grade students of a university school

Reliability: Not available

Norms: Not available

Validation: Face validity

Reference: James Robert K. "A Comparison of Group and Individualized Instructional Techniques in Seventh Grade Science." Unpublished doctoral dissertation, University of Iowa, Iowa City, 1969, pp. 123-129.
University Microfilms Order No. 69-21,698

Title: (13 TESTS)

Factors: Achievement of laboratory skills in chemistry including; equipment identification, general operations, special operations, errors in technique, interpreting experiments, use of tools, designing experiment for several purposes, measurement of characteristics, ordering data, formulating hypothesis and predicting effects of actions.

Format: The 13 tests each consist of one situation with a variable number of questions requiring essay, short answer or matching responses. Situations are presented through color slides and color motion picture scenes.

Population: College chemistry students

Reliability: Not available

Norms: Not available

Variation: Not available

Reference: Jeffrey, Jack C. "Identification of Objectives of the Chemistry Laboratory and Development of Means For Measuring Student Achievement of Some of These Objectives." Unpublished doctoral dissertation, The University of Texas, 1965, p. 154. (Photographic materials not included)
University Microfilms Order No. 66-1928

Title: TAB SCIENCE TEST

Factors: Inquiry behaviors of searching, data processing, verifying, discovering, assimilating and accomodating.

Format: Tab-item

Population: 4, 5, and 6 grade students from wide socioeconomic range

Reliability: Coefficients of equivalence = .420 (N = 238) and internal consistency of .497 (form A) and .532 (form B).

Norms:

Form	Max. Score	Mean	S.D.	N
A	364	296	51.5	1264
B	346	260	58.5	1255

Validation: Concurrent validity analysis with teacher rankings (.64)

Reference: Jones, Howard L. "The Development of a Test of Scientific Inquiry, Using the TAB Format, And an Analysis of Its Relationship to Selected Student Behaviors and Abilities." Unpublished doctoral dissertation, Texas University, Austin, 1966, pp. 104-132.
University Microfilms Order No. 66-7339

Title: RATIO TASK

Factors: Ability to apply the concept of ratio

Format: A problem and categorizations of student responses to the problem

Population: Fourth through twelfth grade

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Robert Karplus and Rita W. Peterson
Science Curriculum Improvement Study
Lawrence Hall of Science
University of California
Berkeley, California 94720

Title: GRAPH INTERPRETATION INSTRUMENT

Factors: Ability to interpret graphs

Format: 15 multiple-choice items based upon graphs

Population: Majors (juniors or seniors) in elementary education

Reliability: Not available

Norms: $\bar{X}$ = 23.23 - 23.25 S.D. = 5.81 - 5.87 N = 53-54 (pre-test)

Validation: Critical examination by experts

Reference: Kellogg, Maurice G. "The Effect of Laboratory-Discovery Methods and Demonstration-Discussion Methods Upon Elementary Science Methods Students' Abilities To Analyze and Interpret Graphs." Unpublished doctoral dissertation, University of Indiana, 1966, p. 87.
University Microfilms Order No. 67-4012

Title: SPECIAL EARTH SCIENCE EXAMINATION

Factors: Level of inquiry ability

Format: 50 multiple-choice items

Population: Ninth grade earth science students

Reliability: Not available

Norms: Not available

Validation: Twenty-four member jury held 89% agreement on items using high versus low inquiry ability.

Reference: Ladd, George T. "Determining the Level of Inquiry in Teachers' Questions." Unpublished doctoral dissertation, Indiana University, Bloomington, 1969, pp. 61-72.
University Microfilms Order No. 70-11,698

Title: (No Title)

Factors: Ability to use evidence from observations aided by scientific instruments

Format: Respondents asked orally to differentiate between masses or volumes of pairs of objects visually and then by use of evidence from balances and graduated cylinders. They indicate their level of confidence in each answer.

Population: Pupils from grades one through six of the Ohio State University School and the public schools of Central Ohio

Reliability: Not available

Norms: Not available

Validation: Pilot testing was used to refine testing technique and materials.

Reference: Menefee, Robert W. "Measuring Elementary School Children's Ability to Use Evidence from Scientific Instruments in decision-Making Situations." Unpublished doctoral dissertation, The Ohio State University, 1965, pp. 13-25.
University Microfilms Order No. 66-6283

Title: FIFTH GRADE SCIENCE PROBLEM SOLVING TEST

Factors: Ability to: 1) identify hypotheses
2) identify problems
3) identify valid conclusions

Format: 36 multiple-choice items based on description of hypothetical situations

Population: Fifth grade students

Reliability: r = .81 (Test-retest method using Pearson's Product-Moment Correlation) N = 811

Norms: $\bar{X}$ = 4.89 to 6.49 N = 27 (each of three groups)

Validity: Content validity purported by author, based on objectives of science education as developed by Commission on Science Education of the American Association for the Advancement of Science.

Reference: O'Toole, Raymond J. "A Study to Determine Whether Fifth Grade Children Can Learn Certain Selected Problem Solving Abilities Through Individualized Instruction." Unpublished doctoral dissertation, Colorado State College, Greeley, 1966, pp. 76-88.
University Microfilms Order No. 67-60800

Title: THE PROBLEM-SOLVING TEST

Factors: Problem-solving skills such as forming, testing, revising and reporting of hypotheses

Format: Respondent reports all he can about the inside of a closed box, collecting data by any means except opening the box. Final test consists of 21 boxes.

Population: College students

Reliability: r = .84 (Split-half method) N = 50

Norms: Not available

Validation: Test scores and time spent on test were compared with scores on standardized instruments which purport to measure aspect of problem solving ability.

Reference: Perisho, Clarence R. "A Problem-Solving Test - The Construction of a Manipulative Performance Test Designed to Induce the Collection and Use of Perceptive Data in the Formulation and Inferential Verification of Hypothesis." Unpublished doctoral dissertation, New York University, 1963, pp. 145-165.
University Microfilms Order No. 63-6674

Title: HYPOTHESIS QUALITY SCALE

Factors: Quality of Scientific Hypotheses

Format: Rating scale: Values 0-5

Population: Sixth through 11th graders in science

Reliability: r = .96 (interjudge technique) N = 50

Norms: Not available

Validation: Content

Reference: Quinn, Mary Ellen. "Evaluation of a Method for Teaching Hypothesis Formation to Sixth Grade Children." Unpublished doctoral dissertation, University of Pennsylvania, 1971.
University Microfilms Order No. 71-25,542

Title: COMPETENCY MEASURES FOR GROUPS

Factors: Assess the 24 specific behaviors listed as behavioral expectancies for exercises A-K of Part A of Science --- A Process Approach.

Format: 56 tasks

Population: Kindergarten students

Reliability: r = .78 (K-R 21) N = 44

Norms: $\overline{X}$ = 33.97 S.D. = 6.24 (Post-test) N = 60

Validation: Content validity by author

Reference: William C. Ritz
Staff Associate
Eastern Regional Institute for Education
635 James Street
Syracuse, N.Y. 13203

Title: LABORATORY PRACTICAL

Factors: Ability in; measurement, identification, interpreting and determining interrelationships

Format: 20 laboratory setups, one question related to each setup

Population: High school biology students

Reliability: Hoyt analysis of variance yielded reliability of .63.
N = 390

Norms: $\overline{X}$ = 11.3 S.D. = 3.2 N = 390

Validation: Not available

Reference: Robinson, James T. "Evaluating Laboratory Work in High School Biology." American Biology Teacher, 31:4:236-240, April, 1969.

Title: LABORATORY PERFORMANCE TEST

Factors: Achievement in physics laboratory skills

Format: 6 laboratory problems

Population: College students enrolled in introductory physics courses

Reliability: r = .596 (K-R 20) N = 124

Norms: $\overline{X}$ = 14.08 (24 points maximum) N = 124

Validation: Three-member panel

Reference: Smith, John R. "A Comparison of Two Methods of Conducting Introductory College Physics Laboratories." Unpublished doctoral dissertation, Colorado State College, Greeley, 1969, pp. 76-79.
University Microfilms Order No. 70-7168

Title: PRACTICAL LABORATORY EXAMINATION

Factors: Laboratory skills (manipulative and intellective) utilized in BSCS curricula

Format: Seven problems with instructions to students and questions to be answered

Population: Twelfth-grade Israeli students

Reliability: High degree of evaluator agreement

Norms: $\bar{X}$ = 74.34 (Maximum = 100) S.D. = 9.49 N = 99

Validation: Content and construct validity claimed by authors

Reference: Tamir, P. and Glassman, F. "A Practical Examination for BSCS Students." Journal of Research in Science Teaching, 7:107-112. (1970) Complete instrument available from authors c/o Israeli Science Teaching Centre, Hebrew University, Jerusalem.

Title: THE TEST OF SCIENCE PROCESSES

Factors: The ability to use the following processes:
1) observing 2) comparing 3) classifying 4) quantifying
5) measuring 6) experimenting 7) inferring 8) predicting

Format: 96 multiple-choice items

Population: Junior high school students

Reliability: r = .90 - .91 total (K-R 20)
Subtest = 1) .41 - .47 2) .26 - .37 3) .58 - .71
4) .64 - .75 5) .71 - .82 6) .43 - .54 7) .48 - .63
8) .32 - .56

Norms: Included in dissertation

Validation: Criterion-related validity assessed through correlation of student scores with the teacher ratings of students. Correlations ranged from .115 to .477.

Reference: Tannenbaum, Robert S. "The Development of the Test of Science Processes." Unpublished doctoral dissertation, Columbia University, 1968.
University Microfilms Order No. 69-677

Title:	ERIE SCIENCE PROCESSES TEST
Factors:	Skills reflecting the process orientation of Science - A Process Approach curriculum
Format:	35 multiple-choice items
Population:	Students in fourth and fifth grades
Reliability:	r = .72 (K-R 20) N = 846
Norms:	Not available
Validation:	Content validity for experimental version of the curriculum
Reference:	Charles W. Wallace, Staff Associate Eastern Regional Institute for Education 635 James Street Syracuse, New York 13203

III. CHARACTERISTICS AND ABILITIES OF STUDENTS

Title: COGNITIVE PREFERENCE EXAMINATION: HIGH SCHOOL CHEMISTRY

Factors: Identifying the following types of cognitive preferences as related to chemical information; 1) memory of facts, 2) practical application, 3) critical questioning of information, and 4) fundamental principles.

Format: 35 items each with four possible correct responses. Responses differ in cognitive type. Respondent chooses the one he prefers.

Population: Eleventh grade chemistry pupils from an urban area

Reliability: r = .41 to .78 (Subscales using test-retest method and the Pearson-Product-Moment formula) N = 44

Norms: 1) $\overline{X}$ = 6.75 S.D. = 3.63 2) $\overline{X}$ = 8.33 S.D. = 3.13

3) $\overline{X}$ = 8.65 S.D. = 4.17 4) $\overline{X}$ = 10.20 S.D. = 3.54

Validation: Face validity established by three-member jury

Reference: Atwood, Ronald K. "A Comparative Study of Achievement in Chem Study Chemistry Among Groups of Eleventh Grade Students Classified on the Basis of Frequency of Choices on a Cognitive Preference Examination." Unpublished doctoral dissertation, Florida State University, Tallahassee, 1966, pp. 62-72.
University Microfilms Order No. 67-321

Title: COGNITIVE PREFERENCE EXAMINATION - II

Factors: Cognitive Preference; memory, application, questioning

Format: Thirty multiple-choice items each having three correct distractors reflecting the three types of cognitive style. Respondent chooses the one he prefers.

Population: Juniors and seniors enrolled in an elementary science and social studies methods course at the University of Kentucky

Reliability: Test-retest stability coefficients using Pearson-Product-Moment:
application r = .77
memory r = .70 N = 100
questioning r = .74

Norms: Not available

Validation: Critiques by parel of judges

Reference: Ronald K. Atwood
Department of Curriculum and Instruction
University of Kentucky
Lexington, Kentucky 40506

Title: RODS, SPRINGS, LEVERS

Factors: Separation of variables

Format: Practical examination with 9 Piaget-type tasks in each of the three subtests

Population: Fifth and sixth grade students

Reliability: r = .79 to .88 (subtests, using K-R 20) N = 27

Norms: Not available

Validation: Not available

Reference: Bredderman, Theodore A. "The Relative Effectiveness of Reinforcement and Conflict Instruction in Developing The Ability to Separate Variables in Fifth and Sixth Grade Children." Unpublished doctoral dissertation, Cornell University, Ithaca, New York, 1967, pp. 97-113.
University Microfilms Order No. 68-3499

Title: SCIENTIFIC CURIOSITY INVENTORY

Factors: Scientific curiosity

Format: Seven sets of statements; within each set respondent is asked to answer yes or no to each statement in context of two questions which are posed at the beginning of the set.

Population: Junior high school science students

Reliability: r = .896 (Spearman-Brown correlation of split-halves)
N = 251

Norms: Not available

Validation: Jury

Reference: James R. Campbell
University of Pennsylvania
Graduate School of Education
3700 Walnut Street
Philadelphia, Pa.

Title: SCIENTIFIC APTITUDE SURVEY

Factors: Fourteen competencies thought important in defining scientific talent

Format: 150 multiple-choice items

Population: Eighth grade students of urban California schools

Reliability: r = .93 (K-R 20) N = 240

Norms: $\bar{X}$ = 74.5 (Max. = 150) S.D. = 16.4 N = 240

Validation: Correlation with final marks in science classes ranged from .68 (N = 69) to .79 (N = 29). Correlation with teacher assessment was .82 (N = 148)

Reference: Cosgrove, John C. "The Identification of Scientific Talent." Unpublished doctoral dissertation, The University of Southern California, 1962, p. 155.
University Microfilms Order No. 63-2144

Title: MULTIPLE-MEANING WORD TEST

Factors: Identification of those meanings of a group of multiple-meaning science words that are known by the respondents

Format: Two parts each containing 80 multiple-choice items

Population: Children in grades four, five and six of the Kingston, New York public schools

Reliability: Split-halves correlation; r = .88 (Pearson Product-Moment Correlation corrected by the Spearman-Brown "Prophecy Formula")

Norms: Girls $\bar{X}$ = 107.59 S.D. = 21.52 N = 256
Boys $\bar{X}$ = 104.86 S.D. = 27.32 N = 270
Maximum score = 160

Validation: Established through opinions of 23 reading specialists. Item analysis by grade level indicated balanced distribution of item by difficulty.

Reference: Howards, Melvin. "Measuring Children's Understanding of Selected Multiple-Meaning Words as it Relates to Scientific Word Lists." Unpublished doctoral dissertation, New York University, 1962, p. 85.
University Microfilms Order No. 63-6665

Title: ISLANDS PUZZLE

Factors: Abstract reasoning ability

Format: A puzzle is posed. A succession of clues are given. Students are asked to write out explanations for answers to questions about the puzzle. Responses are categorized according to criteria developed by authors.

Population: Fifth grade through college

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Elizabeth F. Karplus and Robert Karplus
Science Curriculum Improvement Study
Lawrence Hall of Science
Berkeley, California 94720

Title: ROBINSON TEST OF SCIENTIFIC CREATIVITY

Factors: Scientific Creativity; emphasis on divergent scientific thought

Format: Seven parts; Different uses of objects, Anagrams, Problem Identification and Solution, Unstructured Stimulus, Amusing Incident, Problem Identification and Solution (2), Structural Ingenuity. Short essay responses scored according to a set of criteria developed by author.

Population: Secondary school students

Reliability: Inter-scorer agreement on tests ranged from 84 to 100 per cent

Norms: $\bar{X}$ (experimental group) = 81.84 N = 311
$\bar{X}$ (comparison group) = 68.81 N = 314

Validation: Test results correlated highly with performance of students in Science Fair. Science Fair participants performed better on test than did non-participants.

Reference: Kobe, Katherine E. "Relationship Between Performance On a Scientific Creativity Test and Participation in a Science Fair." Unpublished doctoral dissertation, United States International University, 1968. After p. 95. (includes scoring manual)
Developed by: Dr. Willis Robinson, California Western University (mimeographed)
University Microfilms Order No. 68-14,757

Title: COGNITIVE PREFERENCE TEST: HIGH SCHOOL CHEMISTRY

Factors: Comparison of four types of "cognitive preferences".
1) memory or recall 2) practical application
3) critical questioning 4) identification of a fundamental principle

Format: 100 four-option items; each of the four options reflecting a cognitive type. Respondent chooses the one he prefers.

Population: High school chemistry students

Reliability: Coefficients of reliability*:
1) 0.70 2) 0.50 3) 0.66 4) 0.28
N = 433 (CBA students) Method not given

Norms: Means (Maximum 25) 1) 7.61 2) 7.03 3) 4.53 4) 7.09

Validation: Content validity established by jury of chemists

Reference: R. L. Marks
Department of Chemistry
Indiana University of Pennsylvania
Indiana, Pa. 15701

Title: A TEST OF SCIENCE COMPREHENSION

Factors: Critical thinking

Format: Two parts, each containing 30 multiple-choice items based on four situations arranged approximately in order of difficulty. Respondent must analyze the situation to arrive at answers.

Population: Students in grades 4 through 6 in urban and suburban school systems of Michigan

Reliability: Method - G. J. Froelich (in Garrett)

4th grade r = .72 N = 182
5th grade r = .79 N = 256
6th grade r = .76 N = 213
(Based on post-test of the experimental groups)

Norms: 4th grade $\bar{X}$ = 21.68 Variance = 47 N = 182
5th grade $\bar{X}$ = 31.08 Variance = 64 N = 256
6th grade $\bar{X}$ = 33.05 Variance = 58 N = 213
(Based on post-tests of experimental groups)

Validation: Not available

Reference: Nelson, Clarence H. and Mason, John M. "A Test of Science Comprehension for Upper Elementary Grades." Science Education, Vol. 47, #4, pp. 319-330, October, 1963.

Title: PROBLEM SOLVING TEST

Factors: Problem solving ability

Format: Six problems

Population: College students enrolled in an Introductory Botany course

Reliability: r = .30 and .50 (Jackson method)

Norms: Not available

Validation: Jury of university staff members in Botany and Education

Reference: Novak, Joseph D. "A Comparison of Two Methods of Teaching A College General Botany Course." Unpublished doctoral dissertation, University of Minnesota, 1957, p. 163.
University Microfilms Order No. 58-2159

Title: PHYSICS TEST II

Factors: Mathematical and physics problem solving ability

Format: 45 multiple-choice items

Population: College freshman

Reliability: r = .713 (Split-halves technique using Spearman-Brown formula) N = 211

Norms: Not available

Validation: Content validity by jury. Concurrent validity by comparison with standardized test results and teacher grades.

Reference: Sandler, Barney. "A Comparison of an Integrated Course in College Physics and Mathematics of the Semester Duration with Separate Courses in the Two Subjects in a Two Year Community College." Unpublished doctoral dissertation, New York University, 1961, p. 82.
University Microfilms Order No. 62-1429

Title: COGNITIVE STYLES TASK (CST)

Factors: Extent of respondents' cognitive style in categorization behavior

Format: Respondents group photographs of objects and record their reasons. Each response is placed into one of six categories (See page 64 for scoring techniques).

Population: Ten and eleven year old children enrolled in Detroit elementary schools

Reliability: Not available

Norms: Not available

Validation: Based on an Individual Styles Task instrument developed by Sigel

Reference: Scott, Norval C. Jr. "The Relationship of Inductive Reasoning and Cognitive Styles in Categorization behavior to Science Concept Achievement in Elementary School Children." Unpublished doctoral dissertation, Wayne State University, 1962, p. 201.
University Microfilms Order No. 63-2223

Title: SCIENCE EXPERIENCE INVENTORY

Factors: Determines which of certain experiences are a part of a childs' background

Format: Contains 150 statements such as "See a dust storm." "Yes" answer indicates that student has had the experience.

Population: Fourth, fifth and sixth grade students in the Minneapolis public schools; teachers from Minneapolis and Iowa; students at State University of Iowa.

Reliability: All use K-R 20

r = .94	4th grade	N = 435
r = .93	5th grade	N = 521
r = .75	Minnesota teachers	N = 37
r = .83	Iowa teachers	N = 38

Norms: (Positive responses)

4th grade	$\bar{X}$ = 63.51	S.D. = 22.04
5th grade	$\bar{X}$ = 71.98	S.D. = 22.17
Minnesota teachers	$\bar{X}$ = 117.97	S.D. = 15.37
Iowa teachers	$\bar{X}$ = 105.24	S.D. = 18.27

Validation: Formal validity assumed as test items agree with criteria set up in advance for choosing experiences.

Reference: Uhlhorn, Kenneth. "The Preparation, Use, and Application of a Science Experience Inventory." Unpublished doctoral dissertation, State University of Iowa, 1963, pp. 256-57. University Microfilms Order No. 63-8043

See also: Wahla, James C. "The Relationship Between Sixth-Grade Science Background Experiences and Science Achievement in Selected Urban Elementary Schools." Unpublished doctoral dissertation, University of Michigan, 1967, pp. 73-80.

Title:	PHYSICAL SCIENCE CRITICAL THINKING APPRAISAL
Factors:	The ability to think clearly in physical science
Format:	71 multiple-choice items
Population:	College sophomores enrolled in physical science
Reliability:	r = .71 Split-half technique using Spearman-Brown correlation
Norms:	$\bar{X}$ = 22.60 S.E. = 3.12 N = 362
Validation:	Author selected and developed items with reference to course content. Two course instructors reviewed items for content validity, accuracy and clarity.
Reference:	Zingaro, Joseph S. "An Experimental Comparison Between Two Methods of Teaching College Sophomores The Inter-Relationship of Physicochemical Principles in Physical Science." Unpublished doctoral dissertation, Syracuse University, 1965, pp. 50-80. University Microfilms Order No. 66-9873

IV. ATTITUDES

A. Science, Scientists and Science Classes

Title: THE CALIFORNIA ELEMENTARY SCHOOL SCIENCE ATTITUDE TEST

Factors: Attitudes toward science

Format: 20 Likert-type items

Population: Fifth and eighth grade students

Reliability: r = .73 (Spearman-Brown) N = 2901

Norms: Not available

Validation: Correlation of .47 with science information test

Reference: Brown, Stanley B. "Science Information and Attitudes Possessed By California Elementary Pupils." Unpublished doctoral dissertation, Stanford University, 1951, p. 140.

Available In: Bickel, Robert F. "A Study of the Effect of Television Instruction on the Achievement and Attitudes of Children." Unpublished doctoral dissertation, Syracuse University, 1964, pp. 143-144.
University Microfilms Order No. 65-3447

Title: THE BELIEFS ABOUT AND ATTITUDES TOWARD SCIENCE AND SCIENTISTS SCALE

Factors: Beliefs about science and scientists and attitudes towards those beliefs

Format: Two parts; I - Beliefs and II - Evaluative, each consisting of about 32 multiple-choice items.
Part I scored by awarding one point for each correct answer.
Part II scoring used a complex system relating responses on Part I to responses on Part II.

Population: Developed at an eighth grade reading level. Population consisted of 9-12 graders in three different settings, urban, suburban, and rural.

Reliability: Part I r = 0.79 (K-R 20)
Part II r = 0.86 (Test-retest; Pearson Product Moment Correlation)
Attitude test (combination of Part I and Part II)
r = 0.57 (Test-retest; Pearson Product Moment Correlation)

Norms: N = 50 students at each grade level in each setting.

Attitude scores:
By Setting:

Urban	$\bar{X}$ = 66.81	S.D. = 11.71	N = 141
Suburban	$\bar{X}$ = 72.87	S.D. = 10.42	N = 205
Rural	$\bar{X}$ = 70.15	S.D. = 10.07	N = 135

By Grade Level:

9th	$\bar{X}$ = 68.60	S.D. = 11.22	N = 126
10th	$\bar{X}$ = 67.46	S.D. = 12.72	N = 125
11th	$\bar{X}$ = 71.29	S.D. = 9.03	N = 118
12th	$\bar{X}$ = 73.89	S.D. = 9.51	N = 112

Validation: Item pool submitted to panel of seven judges for classification into belief or evaluation items. Responses were subjected to a two-way analysis of variance and yielded an intraclass (judge) correlation of 0.87. Additional assessments of content validity were made.

Reference: Champlin, Robert F. "The Development and Field Testing of an Instrument to Assess Student Beliefs About and Attitudes Toward Science and Scientists." Unpublished doctoral dissertation, The Ohio State University, 1970, pp. 125-139.
University Microfilms Order No. 71-7417

Title: HOW MUCH DO YOU LIKE

Factors: Attitudes toward science class

Format: 5 items each having a 7 point response scale

Population: Eighth grade students enrolled in physical science classes

Reliability: Not available

Norms: $\bar{X}$ = 24.7 N = 96

Validation: Not available

Reference: Clark, Billy M. "An Experiment in Cultivating Creative Thinking Abilities in the Classroom." Unpublished doctoral dissertation, Iowa State University, 1968, p. 84.
University Microfilms Order No. 68-14,778

Title: INTEREST INVENTORY

Factors: Science interest level

Format: Six parts: Part One - ranking of 10 elementary school subjects in order of student preference; Part Two - nine areas students could read about in library books; Part Three - ten possible occupations; Part Four - ten games and play objects; Part Five - ten articles commonly collected by children; Part Six - Ten places students could visit. For Parts 2-6 respondents indicate degree of like-dislike on a five point scale.

Population: Sixth graders in Wichita Public Schools

Reliability: Instrument given three times to same students. Co-efficients of correlation between results were:
1st and 2nd r = .714 2nd and 3rd r = .786
1st and 3rd r = .719

Norms: Group A (6 classrooms) $\overline{X}$ = 59.2 (Post-test)
Group B (6 classrooms) $\overline{X}$ = 59.0

Validation: Not available

Reference: Downing, Carl E. "A Statistical Examination of the Relationship Among Elementary Science Achievement Gains, Interest Level Changes, and Time Allotment for Instructional Purposes." Unpublished doctoral dissertation, Oklahoma State University, 1963, pp. 118-121.
University Microfilms Order No. 64-8912

Title: ATTITUDE SCALE

Factors: Attitudes toward teaching and learning science

Format: 20 items with weighted values. Agree responses are totalled for score.

Population: Elementary education majors without science background

Reliability: r = .93 (test-retest method) N = 226

Norms: Not available

Validation: Items selected from pool of 200 through Q-sort technique using 100 respondents

Reference: Dutton, Wilbur H. and Lois Stephens, "Measuring Attitudes Toward Science." School Science and Mathematics, 63:43-49, 1963.

Title: STUDENT QUESTIONNAIRE

Factors: Student attitudes toward teacher and learning science

Format: 34 Likert-type items

Population: Junior high school students

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306

Title: STUDENT ATTITUDE TOWARD SCIENCE

Factors: Student acceptance of 1) text material, 2) course content, 3) laboratory work, 4) interest in the course, 5) involvement and 6) satisfaction of perceived needs.

Format: 72 statements using a Likert-type response scale

Population: 10th grade secondary school students taking the "General Course" science program in Manitoba schools

Reliability: Not available

Norms:

Factor	Neutral Score		
1.	39	$\bar{X}$ = 44.2	S.D. = 9.5
2.	36	$\bar{X}$ = 38.5	S.D. = 6.7
3.	42	$\bar{X}$ = 41.0	S.D. = 6.2
4.	51	$\bar{X}$ = 54.4	S.D. =12.2
5.	33	$\bar{X}$ = 38.6	S.D. = 4.9
6.	15	$\bar{X}$ = 16.0	S.D. = 3.3
7.		$\bar{X}$ =232.8	S.D. =32.2

N = 872

Validation: Not available

Reference: Hedley, Robert Lloyd "Student Attitude and Achievement in Science Courses in Manitoba Secondary Schools." Unpublished doctoral dissertation, Michigan State University, 1966, pp. 162-166.
University Microfilms Order No. 67-1635

Title: HOW I FEEL, FORM OZ

Factors: Scale I: Attitude Toward Science Class and Science
Scale II: Anxiety About Science Class

Format: Thirty item, forced-choice instrument

Population: Second and third grade students

Reliability: Internal reliability of each scale was computed from item mean values for the total group using Cronbach's coefficient alpha. Scale I = .564 Scale II = .505 N = 75

Norms: Scale I: $\overline{X}$ = 23.01 S.E. = 0.74
Scale II: $\overline{X}$ = 2.47 S.E. = 0.25 N = 75

Validation: Corrected correlations with IQ scores were essentially zero. It therefore measures something which is independent of IQ.

Reference: Klopfer, Leopold E., Nous, Albert P., McCall, Kathy, "A Study of How Students Feel About Science," Learning Research and Development Center, University of Pittsburgh.

Title: STUDENT REACTION INVENTORY

Factors: Degree of interest of students in various areas of science covered in a science survey course

Format: First part focuses on general factors of interest in science and consists of 72 questions answerable by yes-no response.
Second part consists of a series of 150 words selected from the areas of natural sciences. Respondent indicates his degree of interest in each.

Population: Students at the Newark College of Rutgers University

Reliability: Second part: 50 words were identified. For each original word two corresponding words were selected. This process yielded three equivalent lists of 50 words each. Rank correlations were as follows:

First and second lists r = .729
Second and third lists r = .725 N = 101
First and third lists r = .620

Norms: See dissertation starting on p. 49

Validation: List of terms used agreed on by all course instructors

Reference: Leader, William "The Expressed Science Interests of Students at the Conclusion of a College Science Survey Course and Their Relationship to Achievement in the Course." Unpublished doctoral dissertation, Columbia University, 1951, pp. 76-80.
University Microfilms Order No. 3357

Title: PROJECTIVE TEST OF ATTITUDES

Factors: Attitudes toward science, scientific processes and scientists

Format: Word association items, sentence completion items and an apperception test

Population: Fifth grade students

Reliability: Not available

Norms: Not available

Validation: Interface validity determined between like sections of the instrument

Reference: Lowery, Lawrence F. "An Experimental Investigation Into the Attitudes of Fifth Grade Students Toward Science." Unpublished doctoral dissertation, University of California, Berkeley, pp. 406-429.
University Microfilms Order no. 65-13424

Title: SCIENTIFIC ATTITUDE INVENTORY

Factors: Scientific attitudes

Format: 60 Likert-type items

Population: Low-ability tenth-grade biology students

Reliability: $r = .934$ (Test-retest method of Winer) $N = 23$

Norms: $\overline{X} = 106.22 - 119.16$ $N = 22 - 23$

Validation: Jury

Reference: Moore, Richard W. "The Development, Field Test and Validation of an Inventory of Scientific Attitudes." Journal of Research in Science Teaching, 7:85-94, 1970.

Title: WHAT IS YOUR ATTITUDE TOWARD SCIENCE?

Factors: Attitudes toward science (intellectual)
Attitudes about science (emotional)

Format: 60 Likert-type items

Population: Students in seventh grade through college

Reliability: r = .93 (Test-retest method of Winer) N = 23

Norms: Not available

Validation: Construct validity determined

Reference: Moore, Richard W., Miami University, Oxford, Ohio. "The Development Field Test, and Validation of an Inventory of Scientific Attitudes." Journal of Research in Science Teaching, 7:85-94, 1970.

Title: STUDY OF ATTITUDES TOWARD SCIENTISTS AND SCIENCE

Factors: Attitude toward scientists and science

Format: Two forms consisting of items answerable on a 9 point scale from "Highest Appreciation" to "Highest Depreciation" (32 items and 44 items)

Population: Students enrolled in introductory college chemistry course

Reliability: 1) Test divided into two parts each of which had the same mean score. Split half technique using Spearman-Brown formula yielded an r = .63 (N = 212)
2) Test-retest method yielded an r = .60 (N = 119)

Norms: $\overline{X}$ (pretest) = 2.60 S.D. = 0.58 N = 467
$\overline{X}$ (post-test) = 2.69 S.D. = 0.73

Validation: Opinions forming the statements to be included in the instrument were rated by three groups of judges on the one to nine scale.

Reference: Myers, Byron E. "An Appraisal of Change of Attitudes Toward Science and Scientists and of Student Achievement in an Introductory College Chemistry Course Relative to the Students' Backgrounds in High School Chemistry and Physics." Unpublished doctoral dissertation, The Pennsylvania State University, 1967, p. 284.
University Microfilms Order No. 68-8727

Title: SCIENTIFIC ATTITUDE TEST

Factors: Attitudes toward science

Format: Student indicates feelings toward 35 ideas or activities (unpleasant, pleasant, none)

Population: College students enrolled in Introductory Botany

Reliability: r = .53 (Hoyt method)

Norms: Pre-test X = 28.68 and 28.88

Validation: Jury of university staff members in Botany and Education

Reference: Novak, Joseph D. "A Comparison of Two Methods of Teaching A College General Botany Course." Unpublished doctoral dissertation, University of Minnesota, 1957, p. 159. University Microfilms Order No. 58-2159

Title: ATTITUDES TOWARD SCIENCE AND SCIENCE TEACHING

Factors: Changes in attitude as a result of the introduction of some experimental variable:
(1) Toward Science (2) Toward Teaching Science

Population: Elementary teachers, elementary education majors and college freshman

Reliability: Split-half (Spearman-Brown correction)
1) r = .88 2) r = .84 N = 154

Norms: Means: 1) 62.18 (Max. = 80)
2) 54.78 (Max. = 80) N = 45

Validation: Internal consistency

Reference: Redford, Elmer G. "Attitude Testing of Elementary Education Majors in Physical Science 130 at Wisconsin University - Whitewater." Final Report (unpublished). Available from the author c/o Physics Department, WSU-U, Whitewater, Wisconsin 53591

Title: SCIENCE ATTITUDE SCALE

Factors: Attitude toward subject of science

Format: 33 Likert-type items

Population: Sixth grade students

Reliability: Reliability coefficient alpha = .90 N = 115

Norms: $\overline{X}$ = 114.40 S.E. = 1.78 N = 115

Validation: Jury of four

Reference: Shrigley, Robert L. "Handmade Versus Commercial Equipment in Elementary School Science." Unpublished doctoral dissertation, Pennsylvania State University, University Park, 1968.
University Microfilms Order No. 69-9807

Title: BIOLOGY STUDENT BEHAVIOR INVENTORY

Factors: Science attitudes, interests: 1) curiosity, 2) openness, 3) satisfaction, 4) responsibility

Format: Several types of items are used including:
1) Situations are explained and students asked to indicate what they might do in the given situation.
2) Students are asked the extent to which they agree with a stated opinion.

Population: Tenth grade biology students

Reliability: Split-half corrected N = 1,153
1) .67 2) .68 3) .71 4) .37

Norms: Not available

Validation: Content validity by panel of judges, item validity through internal consistency, and concurrent validity by three different methods.

Reference: H. Edwin Steiner, Jr.
305B Chemistry Building
University of South Florida
Tampa, Florida 33620

Title: INVENTORY OF SCIENCE ATTITUDES, INTEREST AND APPRECIATIONS

Factors: Affective outcomes of science teaching

Format: Part I - 50 statements reflecting attitudes about science
Part II - 21 statements concerning possible experience of respondent
Possible responses: Agree, disagree, no opinion

Population: Sixth grade students

Reliability: Not available

Norms: $\bar{X}$ = 41.93 S.D. = 9.1 N = 1518

Validation: Not available

Reference: Swan, Malcolm D. "An Exploratory Study of Science Achievement As It Relates to Science Curricula and Programs at the Sixth-Grade Level in Montana Public Schools." Unpublished doctoral dissertation, University of Montana, 1965, pp. 196-199.
University Microfilms Order No. 65-12980

Title: ATTITUDE SCALE

Factors: Generalized attitude toward science

Format: 80 items using 7 point Likert-type scale

Population: 9th and 10th graders

Reliability: r = 0.87 (K-R 20) N = 350

Norms: Not available

Validation: Criteria derived from literature provided bases for development of items.

Reference: Vitrogen, David "A Method for Determining a Generalized Attitude Toward Science." Unpublished doctoral dissertation, New York University, New York, 1965.
University Microfilms Order No. 66-9525

Title: SEMANTIC DIFFERENTIAL TEST

Factors: Attitude 1) Me Teaching Science
2) Doing Experiments
3) Science

Format: Semantic differential

Population: College students enrolled in Introductory Physical Science

Reliability: Factors
1. Five clusters varied from .68 to .84
2. Five clusters varied from .49 to .82
3. Cluster reliabilities too low to be used
Method: Stepped-up r_{ii}

Norms: Post-test, experimental group
1. $\bar{X}$ 3.23 - 5.98 S.D. 1.00 - 1.35
2. $\bar{X}$ 3.66 - 5.87 S.D. .67 - 1.18 N = 301

Validation: Three hypothesized clusters were found to exist, although reliabilities on one were too low for it to be included.

Reference: Wayne Welch
University of Minnesota
Minneapolis, Minn. 55455

B. Toward Conservation and Environment

Title: ATTITUDE TOWARD CONSERVATION

Factors: Attitudes about conservation of natural resources

Format: 64 Likert-type items

Population: High school, college, and adult groups

Reliability: Not available

Norms:

High school	$\bar{X}$ = 184.08	N = 585
College	$\bar{X}$ = 191.32	N = 462
Adult	$\bar{X}$ = 196.93	N = 571

Validation: Not available

Reference: George, Robert W. "A Comparative Analysis of Conservation Attitudes in Situations Where Conservation Education is a Part of the Educational Experience." Unpublished doctoral dissertation, Michigan State University, 1966, p. 128.
University Microfilms Order No. 66-14,123

Title:	AN ATTITUDE INVENTORY
Factors:	Attitudes toward conservation
Format:	32 Likert-type items
Population:	College juniors and seniors
Reliability:	Not available
Norms:	Not available
Validation:	Not available
Reference:	Hoover, Kenneth H. and Shutz, Richard E. "A Factor Analysis of Conservation Attitudes." Science Education, 47:1:62-63, February, 1963.

Title:	(None)
Factors:	Attitudes toward conservation
Format:	116 Likert-type items
Population:	College juniors and seniors
Reliability:	A cluster analysis of items yielded 16 clusters with K-R 20 reliabilities ranging from .40 to .93.
Norms:	Not available
Validation:	Not available
Reference:	Hoover, Kenneth H. and Schutz, Richard E. "Conservation Attitudes." Science Education, 47:1:63-68, February, 1963.

Title:	INVENTORY OF SOCIETAL ISSUES
Factor	Seven interpretable factors were found relating to environmental issues and society's and the individual's role in these issues.
Format:	60 Likert-type items
Population:	A representative sample of seniors in the public high schools of Oregon

Reliability: Total Instrument - Cronbach alpha r = 0.647
Spearman-Brown Prophesy formula r = 0.768
Pearson-Product-Moment Correlation r = 0.624
Reliabilities of factor scales ranged from 0.48 - 0.85 using Spearman-Brown Prophesy Formula.
N = 304

Norms: See pages 107-121 of dissertation

Validation: A pool of items was generated following certain established ground rules. From a series of administrations of the pool items and their analysis a pool of 100 items were selected. These were evaluated by professors from sciences, humanities, and social sciences. Factor analysis resulted in selection of 60 items for final version.

Reference: Steiner, Robert I "A Factor Analytic Study of the Attitudes of Oregon High School Seniors Toward Socially Significant Science - Related Issues." Unpublished doctoral dissertation, Oregon State University, 1971, pp. 143-148.
University Microfilms Order No. 71-19,912

Title: LAUG TEST OF ATTITUDES TOWARD CONSERVATION

Factors: Attitudes toward conservation

Format: 66 Likert-type items

Population: College freshman

Reliability: r = .94 (Spearman-Brown)

Norms: Not available

Validation: Not available

Reference: Whiteman, Eldon E. "A Comparative Study of the Effect of a Traditional and a Specially Designed College Course in Biology Upon Conservation Attitudes." Unpublished doctoral dissertation, Michigan State University, 1965, pp. 108-112.
University Microfilms Order No. 65-14,289

Instrument developed by George M. Laug, New York State University, College of Buffalo.
See: Laug, George M. "A Study of Expressed Attitudes of Prospective Teachers Taking Part in Practical Conservation Activities." Unpublished doctoral dissertation, Syracuse University, 1960.
University Microfilms Order No. 60-2609

V. KNOWLEDGE OF THE NATURE OF SCIENCE

Title: IOWA SCIENCE AND CULTURE STUDY ACHIEVEMENT TEST

Factors: Understanding of science as related to culture

Format: 50 multiple-choice items

Population: 11th and 12th grade students

Reliability: r = .63 (Pre and post test correlation using Pearson-Product-Moment) N = 21

Norms: Not available

Validation: Correlation of scores with published instruments which were also used in study

Reference: Cossman, George W. "The Effects of A Course in Science and Culture Designed for Secondary School Students." Unpublished doctoral dissertation, University of Iowa, Iowa City, 1967, p. 96.
University Microfilms Order No. 68-913

Title: TEST OF SOCIAL ASPECTS OF SCIENCE

Factors: Understanding of the interaction of science and society

Format: 52 Likert-type items

Population: High school sophomores

Reliability: r = .71 (K-R 20 with agree responses scored as correct) N = 140

Norms: $\overline{X}$ = 33.26 S.D. = 6.29 N = 155

Validation: Twelve-member jury

Reference: Korth, Willard W. "The Use of the History of Science to Promote Student Understanding of the Social Aspects of Science." Unpublished doctoral dissertation, Stanford University, California, 1968, pp. 55-60.
University Microfilms Order No. 68-15069

Title:	TEST ON THE METHODOLOGY OF SCIENCE
Factors:	Understanding of the methodology of science
Format:	55 multiple-choice items (final versions)
Population:	In-service science teachers
Reliability:	r = .63 (K-R 20) N = 53
Norms:	$\bar{X}$ = 24.98 S.D. = 5.50
Validation:	Jury comprised of 10 authorities on the philosophy of science
Reference:	Meinhold, Russell. "An Analysis of the Scores of Science Teachers on a Test of the Methodology of Science." Unpublished doctoral dissertation, 1961, pp. 129-136. University Microfilms Order No. 61-5424

Title:	WISCONSIN INVENTORY OF SCIENCE PROCESSES
Factors:	Knowledge of the scientific enterprise
Format:	93 statements; respondent asked to judge whether each is an accurate or inaccurate statement.
Population:	Twelfth grade students and teachers
Reliability:	r = 0.82
Norms:	Students $\bar{X}$ = 54.2 Teachers $\bar{X}$ = 66.9
Validation:	Not available
Reference:	Dr. Milton O. Pella The Scientific Literacy Research Center The University of Wisconsin Madison, Wisconsin

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Title:	THE ABRIDGED SCIENTIFIC LITERACY INSTRUMENT
Factors:	Attitudes toward science and understanding of interrelationships in science
Format:	34 situation establishing items with seven-point scale for response
Population:	High school graduates enrolled as college freshmen
Reliability:	Not available
Norms:	Not available N = 358
Validation:	36-member jury participated in selection of items for final version of instrument
Reference:	Richardson, John S. and Showalter, Victor. "Effects of a Unified Science Curriculum on High School Graduates." The Ohio State University, Columbus, 1967, pp. 59-65. ED 024 593 MF $0.65 HC $6.58 105 pp.

Title:	WELCH SCIENCE PROCESS INVENTORY, FORM D (Earlier form, C, also available)
Factors:	Achievement of science process goals
Format:	Respondent asked whether he agrees or disagrees with each of 135 items
Population:	High school students and adults
Reliability:	r = .86 (K-R 20) N = 171
Norms:	$\bar{X}$ = 103.78 S.D. = 13.10 Range 33-132 N = 1058
Validation:	Content validity established by opinion of experts
Reference:	Dr. Wayne W. Welch 330 Burton Hall University of Minnesota Minneapolis, Minn. 55455

Title:	THE METHODS AND PROCEDURES OF SCIENCE: AN EXAMINATION
Factors:	Assesses student understanding of aspects of the methods and procedures reflected in a scientist's attack on a problem.
Format:	Instrument consists of 50 statements. Respondent chooses from among five words or phrases the one that best characterizes the information in each statement.
Population:	Students in grades 9 through 12
Reliability:	r = .80 (K-R 20) N = 476
Norms:	$\bar{X}$ = 18.9 S.E. = 0.3 N = 476
Validation:	Instrument critiqued by approximately 20 science educators
Reference:	John H. Woodburn, Ph.D. 9208 Le Velle Drive Chevy Chase, Maryland 20015

VI. PROFESSIONAL PRACTICES

A. Instructional Activities

Title: BIOLOGY LABORATORY ACTIVITY CHECKLIST

Factors: Nature and extent of laboratory instruction in biology classes; 1) Pre-Laboratory activities; 2) Laboratory activities; 3) Post-Laboratory activities; and 4) General reaction to the laboratory

Format: 60 true-false items each referring to a laboratory practice. Students respond according to their perceptions of whether the teacher uses that practice.

Population: Tenth grade biology students

Reliability: Two classes for each of five high school biology teachers were used. A *t*-test was computed for the two classes of each teacher. In each of the five cases the *t* was not significant.

Norms: Groups include one class for each of 21 teachers

Group EB (Experienced BSCS Teachers) $\overline{X} = 39.25$
Group BB (Inexperienced BSCS Teachers) $\overline{X} = 33.46$
Group NB (Traditional Biology Teachers) $\overline{X} = 28.87$
Maximum Score = 60

Validation: 1) Each item was based upon statements by individuals who participated in the development of the BSCS program.

2) Each item was verified by a panel of judges who were familiar with the BSCS program.

Reference: Barnes, Lehman W. Jr. "The Development of a Student Checklist to Determine Laboratory Practices in High School Biology." Research and Curriculum Development In Science Education, The University of Texas, Publication Number 6720, October 15, 1967, pp. 90-96.

Title: INSERVICE INSTITUTE QUESTIONNAIRE

Factors: Assess the impact of an inservice institute upon teachers' classroom practices

Format: 50 items

Population: Junior high school teachers

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306

Title: QUESTIONNAIRE FOR PRINCIPAL, SUPERVISOR, CURRICULUM COORDINATOR, ETC.

Factors: Evaluation of impact of inservice institute upon teachers and teachers' classes

Format: Respondent asked to indicate relative agreement with each of 25 statements.

Population: Junior high school administrators and supervisors

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306

Title: BIOLOGY CLASSROOM ACTIVITY CHECKLIST

Factors: The identification of actual classroom practices as they relate to the philosophy and rationale of the BSCS program; A - The role of the teacher in the classroom; B - Student classroom participation; C - Use of textbook and reference materials; D - Design and use of tests; E - Laboratory Preparation; F - Type of laboratory activities; G - Laboratory follow-up activities.

Format: 53 true-false statements each referring to a classroom practice. Students respond according to whether they perceive the practice as being used by their teacher.

Population: Tenth grade biology students in eleven different states

Reliability: r = .96 using a procedure developed by Horst, P. "A Generalized Expression of the Reliability of Measures." Psychometrics. 1949, 14, pp. 21-32.

Norms: N = 1231 from 64 different classrooms

Group EB (Experienced BSCS Teachers) $\bar{X}$ = 65.70 S.D. = 8.14
Group BB (Inexperienced BSCS Teachers) $\bar{X}$ = 57.34 S.D. = 6.37
Group NB (Teachers not teaching BSCS) $\bar{X}$ = 50.04 S.D. = 5.90
Maximum score = 100 (% correct)

Validation: Items based on published statements of BSCS rationale. Five judges were asked to decide the degree to which each classroom practice contributed to BSCS objectives. There was a correlation of .84 among the judges decisions.

Reference: Kochenderfer, Leonard H. "The Development of a Student Checklist to Determine Classroom Teaching Practices in High School Biology." Research and Curriculum Development in Science Education." The University of Texas, Publication Number 6720, October 15, 1967, pp. 71-76.

Title: SURVEY OF STUDENT PERCEPTION OF COURSE AND COLLEGE

Factors: Student perceptions of college environment (part I) and of instructor and general biology class (part II)

Format: Part I: 50 Likert-type items
Part II: 15 multiple-choice items

Population: General biology students in Jamestown Community College and in the State University of New York at Buffalo

Reliability: Not available

Norms: Not available

Validation: Items selected from: "Factored Scales for Measuring Characteristics of College Environments" Nunnally, et. al. Education and Psychology Measurement; 1963, 23, pp. 239-248, and The University of Minnesota, "Survey of Student Reactions to a Course and Instruction," 1961.

Reference: Kochersberger, Robert C. "A Comparison of Achievement of General Biology Students in a Community College with Similar Students in a University as Related to Their Backgrounds." Unpublished doctoral dissertation, State University of New York at Buffalo, 1965, p. 120.
University Microfilms Order No. 65-8896

Title:	LEVEL OF ADOPTION SCALE FOR SCIENCE TEACHING INNOVATIONS
Factors:	Identifies the level at which innovative investigations have been adopted; awareness, interest, evaluation, trial, adoption.
Format:	Ten investigations are described. Teachers indicate which one of seven statements best reflects his level of awareness or utilization of the investigation.
Population:	Elementary school teachers K - 6
Reliability:	r = .65 (Test - retest correlation) N = 94
Norms:	Not available
Validation:	Content validity established by comparing instrument items with experiences included in an inservice program.
Reference:	Kenneth R. Mechling Clarion State College Clarion, Pa. 16214

Title:	SCIENCE CLASSROOM ACTIVITY CHECKLIST 1) Teacher Perceptions 2) Student Perceptions
Factors:	1) Nature of classroom activities which teachers feel should be used for secondary school science instruction. 2) Nature of activities which teachers do use as perceived by their students.
Format:	60 statements of activities with yes-no responses possible. (Based on instrument developed by Leonard Kochendorfer and Addison E. Lee, Research and Curriculum Development in Science Education, Science Education Center, The University of Texas, Austin, Texas, October, 1962.)
Population:	Junior and senior high school science teachers in central Ohio
Reliability:	1) r = .841 (K-R 20) 2) r = .770 (K-R 20)
Norms:	Not available

Validation: Authoritative validity established as a result of a 100% agreement in responses between 4 science educators and author to items on checklist when asked to respond so that their answers would reflect those classroom practices which they felt contributed positively to contemporary science education objectives.

Reference: Sagness, Richard L. "A Study of Selected Outcomes of a Science Pre-Service Teacher Education Project Emphasizing Early Involvement in Schools of Contrasting Environmental Settings." Unpublished doctoral dissertation, The Ohio State University, 1970, p. 189.
University Microfilms Order No. 71-7555

Title: A DICHOTOMOUS KEY FOR IDENTIFYING A RESEARCH-ORIENTED CLASS AS OPPOSED TO A CONVENTIONAL CLASS IN ADVANCED BIOLOGY

Factors: Classroom behavior of teachers and students

Format: Seven dichotomous items

Population: 11th and 12th grade biology classes

Reliability: r = .34 - .98 (Inter-observer agreement) N = 102

Norms: Not available

Validation: Panel of judges critiqued items

Reference: Alva N. Smith
7 North Jay Street
Lock Haven, Pa. 17745

Title: SCIENCE TEACHING INFORMATION QUESTIONNAIRE

Factors: Organization of science program
Organization of instruction
Science teacher personal and biographical data

Format: Six pages of statements in multiple response format

Population: Sixth grade teachers

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Swan, Malcolm D. "An Exploratory Study of Science Achievement As It Relates to Science Curricula and Programs At The Sixth Grade Level in Montana Public Schools." Unpublished doctoral dissertation, University of Montana, 1965, pp. 201-207.
University Microfilms Order No. 65-12980

Title: STUDENT CHECKLIST

Factors: Degree of inductive-indirect or expository-direct strategy used in a laboratory teaching situation.

Format: 42 items describing characteristic teaching activities. Respondents indicate by yes-no answer whether each is being carried on in their classroom. Two scores are obtained representing the two teaching strategies.

Population: Students in 7-12 grade science classes of the Boulder Valley Schools, Boulder, Colorado

Reliability: Expository-direct scale r = .505
Inductive-indirect scale r = .669 N = 1446
Using Hoyt ANOVA method (Hoyt, C. "Test Reliability Established by Analysis of Variance." Psychometrika 6:103-60, 1941)

Norms:

Expository-direct	$\overline{X}$ = 7.27	S.D. = 1.89	20 items
Inductive-indirect	$\overline{X}$ = 11.01	S.D. = 1.80	22 items

N = 1446

Validation: Judges rated items with reference to the type of teaching strategy represented by the described activity.

Reference: Dr. Arthur L. White
Center for Science and Mathematics Education
The Ohio State University
1945 North High Street
Columbus, Ohio 43210

B. Beliefs and Attitudes

Title:	STUDY OF TEACHER REACTIONS TO BSCS PROGRAM; ATTITUDE INVENTORY
Factors:	Teacher attitudes towards the BSCS Biology Program
Format:	Respondent checks those statements with which he agrees from a list of 46. Half of the statements reflect attitudes favorable to BSCS biology and the remainder, traditional biology.
Population:	Biology teachers enrolled in a Summer Institute
Reliability:	Not available
Norms:	Not available
Validation:	Attitude inventory agreed with peer ratings and results of a follow-up questionnaire when each was used in classifying teachers attitudes toward BSCS biology.
Reference:	Blankenship, Jacob W. "The Development of An Attitude Inventory Designed to Determine Reactions of Biology Teachers to BSCS Biology." Research and Curriculum Development in Science Education. The University of Texas Publication, Number 6720, October 15, 1967, pp. 21-28.

Title:	ELEMENTARY SCIENCE "BELIEFS"
Factors:	Beliefs about the nature of elementary school science, children and teaching
Format:	30 Likert-type items
Population:	Prospective or in-service elementary school teachers
Reliability:	Not available
Norms:	F ratios for pretest vs post-test, means determined for each item.
Validation:	Not available
Reference:	Good, Ronald G. "A Study of the Effects of a "Student-Structured" Laboratory Approach to Elementary Science Education Methods Courses: Affective Domain." Journal of Research in Science Teaching, Vol. 8:3:255-262, 1971.

Title:	(None)
Factors:	Knowledge of program characteristics of AAAS Science -- A Process Approach and Science Curriculum Improvement Study.
Format:	57 multiple-choice items
Population:	College teachers of elementary science and curriculum coordinators of science
Reliability:	r = .6770 (K-R 20) N = 29
Norms:	$\bar{X}$ = 34.89 S.D. = 5.55 S.E. = 3.08
Validation:	Panel of science educators
Reference:	Dr. Dale G. Merkle Shippensburg State College Shippensburg, Pa. 17257

Title:	ATTITUDE SURVEY
Factors:	Respondent assesses the developmental potential of a particular academic or social skill through a given content area; Arithmetic, Language Arts, Reading, Science, Social Studies.
Format:	75 questions with response indicated on a 7 point scale
Population:	1) Undergraduates in elementary education 2) Experienced teachers
Reliability:	Two way analysis of variance reported on p. 53 of reference. Reliabilities with one exception are in excess of .70.
Norms:	Not available
Validation:	Construct validity established through use of expert opinion
Reference:	Nelson, Paul A. "Attitudes Held By Elementary Education Teachers Toward the Developmental Potential of the Content Areas." Unpublished doctoral dissertation, University of Illinois, 1968, pp. 121-128. University Microfilms Order No. 69-10,807.

Title: (None)

Factors: Attributes of individuals engaged in training science teachers

Format: 100 statements of major issues in science education; Respondent is asked to indicate agreement or disagreement with each.

Population: Science teacher trainees at colleges and universities

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Weaver, Edward K. "Reactions of Science Educators to Certain Published Science Education Findings." Science Education, Vol. 47:1:50-52, February, 1963.

C. Supervisory Practices

Title: SUPERVISORY PRACTICES INSTRUMENT

Factors: Supervisory practices of science supervisors

Format: Ten case studies of supervisory problems are presented with five possible solutions to each. Solutions are paired with each other. Best of each pair is selected. (Paired comparison)

Population: Secondary school science supervisors

Reliability: Not available

Norms: Not available

Validation: Jury selected from membership of NSSA (23) and science educators (18)

Reference: Goode, John M. "The Development of An Instrument To Evaluate Certain Practices In Science Supervision." Unpublished doctoral dissertation, The Ohio State University, Columbus, 1968, pp. 110-115.
University Microfilms Order No. 68-12840

D. Teacher Expectations of Students

Title: EXPECTATIONS INVENTORY

Factors: Teacher expectation of students

Format: Respondents asked to indicate proportion of their students that could do each of 24 activities. Instrument assesses the degree to which class can function in an open learning environment.

Population: Junior high school students

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306
